THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CVII. No. 2419.] LONDON, SEPTEMBER 21, 1909. [61ST YEAR. PRICE 6d.

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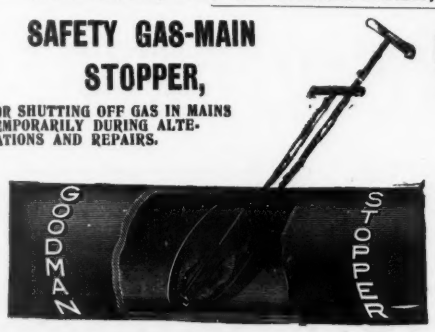

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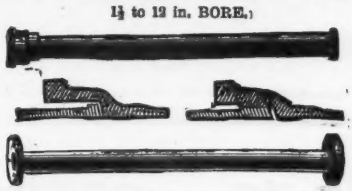

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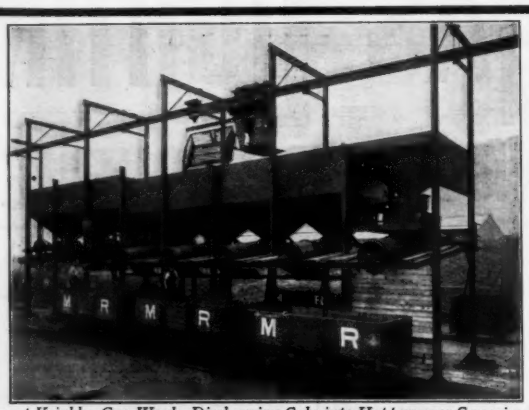

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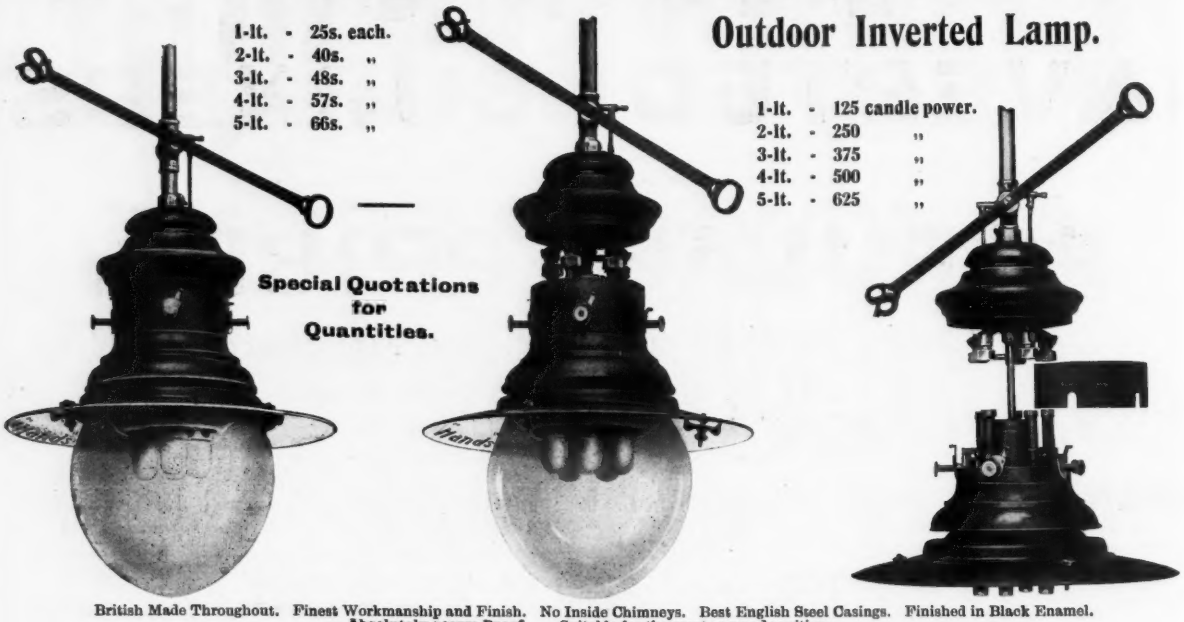

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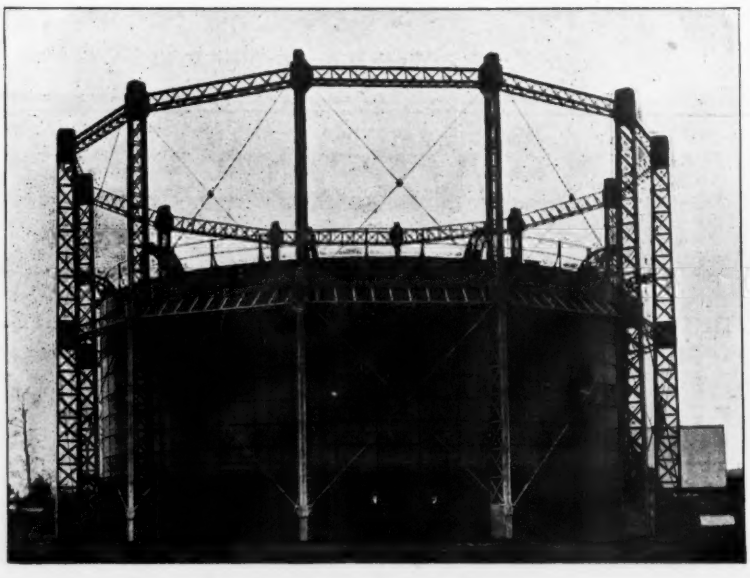

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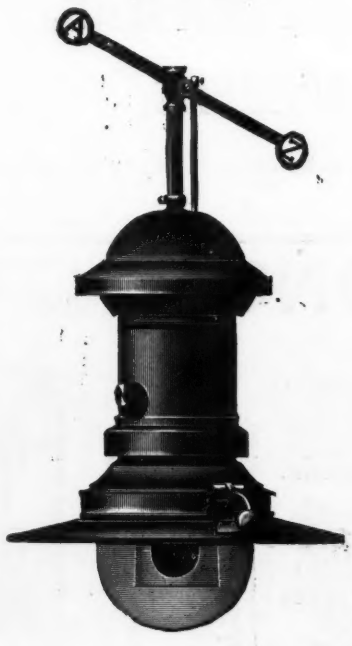

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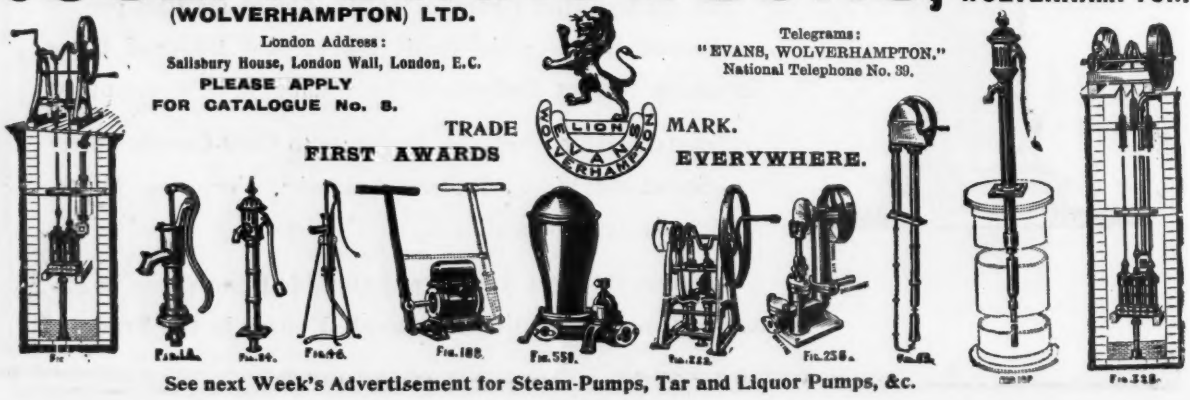

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Fig. I.586.

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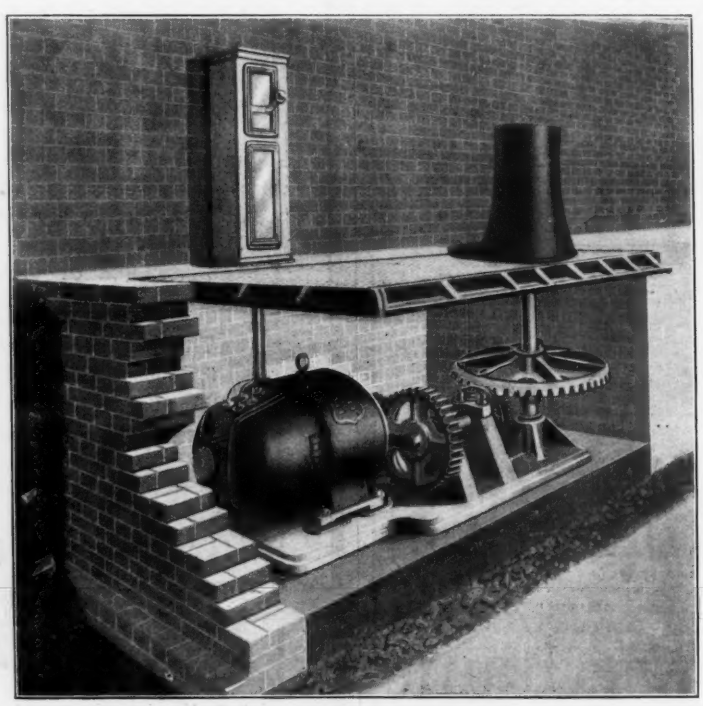

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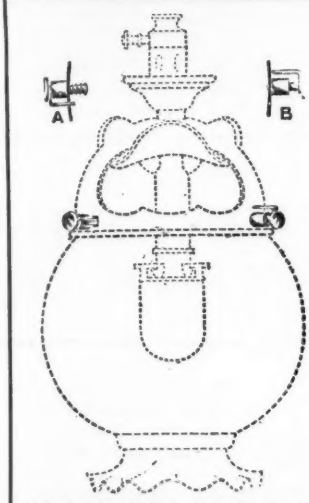

Illustration of Patent Spring Globe Holder, fitted to Globe Gallery, and sectional view of same.

In addition to their already **well-known sterling qualities,** the original pattern **Veritas Inverted Burner** and the **Veritas Shell Burner** are now fitted with **Patent Spring Globe Holders** (as illustrated in the accompanying diagram) simplifying the **fitting to** and **removal of Globes** from Burner, also **reducing breakage** by allowing a **free expansion** of the Glass.

They are also fitted with **New Air Regulating Cup** enabling the adjustment of Burner whilst alight, and **New and Improved Gas Adjuster** with thumbscrew of Black Non-Heating Material.

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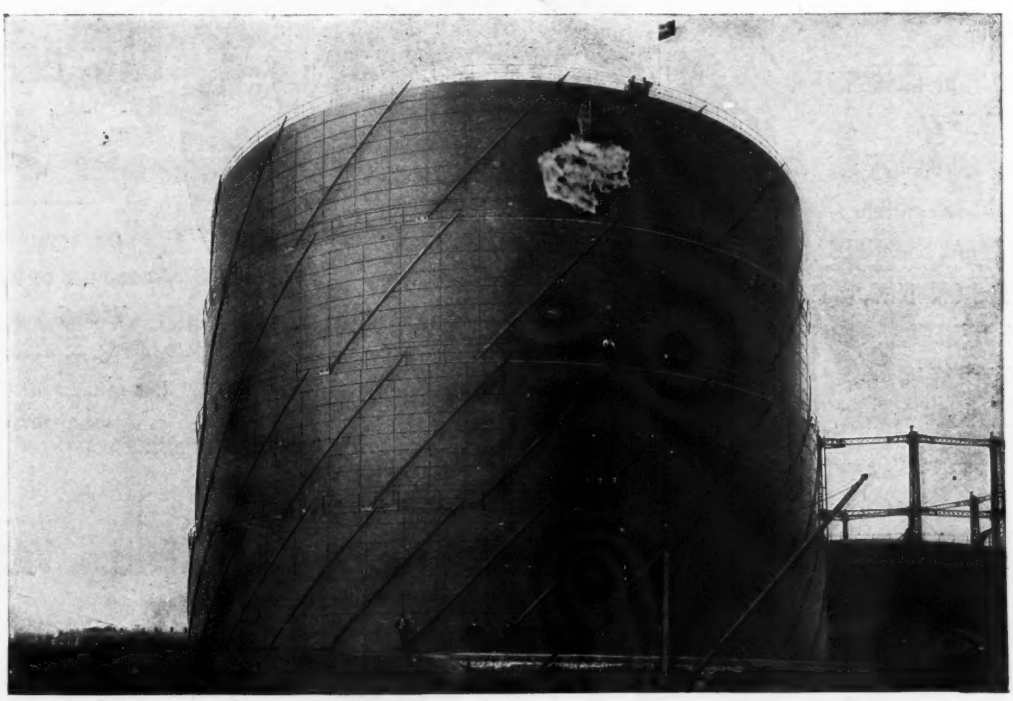

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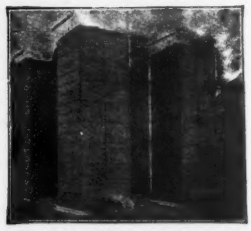

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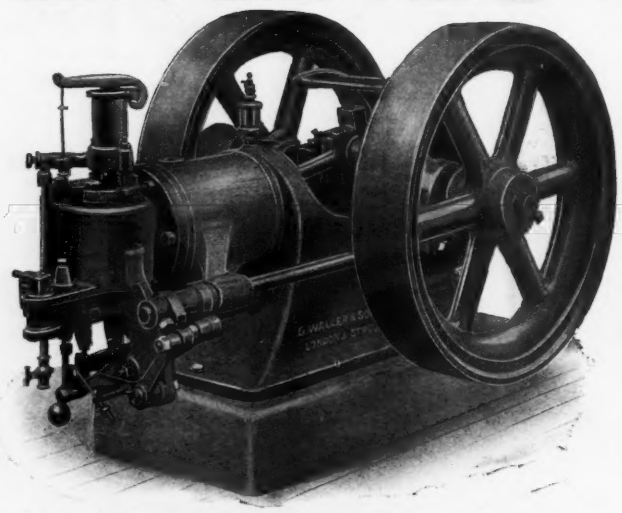

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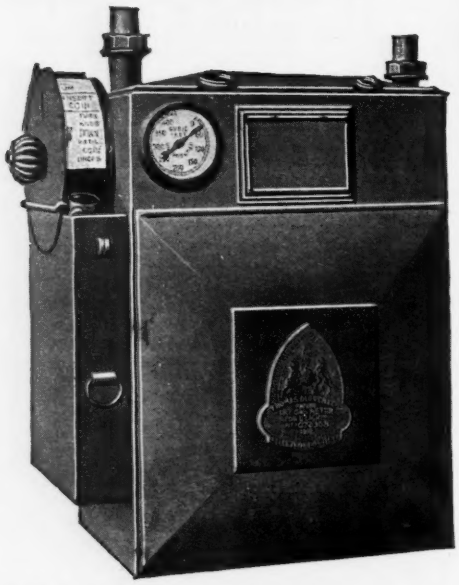

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EDITORIAL NOTES—GAS, &c.

Calorific Power Clauses.

THOUGH the general terms of the calorific power standard and testings to be applied to the Gaslight and Coke Company are widely known in the gas industry, it will be both interesting and useful, this being the first statutory calorific standard with penalties for defects, to publish from the Company's Act the text of the clauses dealing with the matter. This we do in other columns to-day. From the clauses, it will be manifest to our readers that the scheme, so far as the standard and conditions are concerned, excepting the forfeitures, may be regarded as purely tentative. Nevertheless it marks the advent of the statutory testing of gas for its calorific power; and such testing has come to stay—under what circumstances is a matter for the future. However, the standard before us is subject to several conditions; and this betokens a recognition (though the recognition was not obtained without close discussion) that, this being such a complete innovation, the Company, as far as possible, should be protected against the odium of penalty for a relatively small transient lapse from the standard, and beyond there is the reference to the Board of Trade as to a triennial revision of the standard, which will give an opportunity for the discussion of a simplified standard at the end of 1912.

Briefly let us recapitulate the terms of the standard and test. The standard is to be 125 calories (say, 500 B.Th.U.) net; but the Company positively declined to be subject to such a standard for 14-candle gas with a penalty attached. They are therefore not to be mulct so long as the gas is not more than 10 per cent. below the standard—that is to say, so long as it is not below 112½ calories. If the gas on any one day is deficient of calorific power not exceeding 6 calories below the 112½ calories, then, in the Administrative County of London, the average of the tests of that day and the preceding and following days is to be taken; and if the average is not then less than the 112½ calories, the Company will be exempt from forfeiture. In the case of the district occupied by the West Ham Company (which is being taken over by the Gaslight Company), the average of three days' tests, in the event of the gas being not exceeding 6 calories below the 112½ calories, is to be ascertained by taking the results of the two days following, and not the day preceding and the day following, the one on which the deficiency occurred. It seems opposed to common sense that a standard should exist that does not carry a penalty, under conditions; and the whole scheme in this case points to the 125 calories net being an unfair standard, and one not to be entertained without the modifying terms. Virtually, the standard is 112½ calories; the figure above a sort of "false god," and meaningless and without utility. It is early to foretell the future, or to form any judgment as to what will be the experience from Jan. 1 next; but, in the scheme itself, there is to be found sufficient reason for encouraging the belief now that, at the end of three years, steps will be taken to rule out the unserviceable 125 calories. It can be understood that the London County Council—being the London County Council—were tenacious in the matter of the 125 calories, so that they might have a margin in hand in which to endeavour to move up the penalty-line at some future time, if considered expedient; but the whole of the tests that have been taken, for information purposes in London, show the impossibility of proving the expediency or the justice of any such action.

As to forfeitures, the rigorous manner in which gas is tested in London at statutory testing-places governing the whole Metropolitan area, is well known; but the clauses in the Act have ensured that the controlling authority in the Administrative County of London shall only secure a forfeiture in respect of deficiency at one testing-place per day; and that in the West Ham area only one controlling authority shall secure a forfeiture for deficiency on any one day. Subject to the conditions that are outlined above, the forfeitures are to be as follows: For a deficiency not exceeding 3 calories, £5; and exceeding 3 calories but not amounting to 6 calories, a sum not exceeding £10. So far, the penalties in the Administrative County of London and the West Ham area are alike. It will be observed that to keep the penalty for a larger deficiency than 3 calories to within £10, the deficiency must not amount to 6 calories—it must be something under, and not up to, 6 calories. The reason for this is seen in the succeeding provision, to the effect that, in the Administrative County of London, for each *complete* 6 calories of defective power, the forfeiture is to be not less than £25, and not exceeding £100. This is substantial; but it will only apply when the average of three days' testings is down to 106½ calories. For the West Ham district, the corresponding provision is not so onerous, in that the forfeiture for each complete 6 calories of defective power is not to exceed £20. These broadly are the main features of the clauses. There are several minor conditions, which are available to interested readers by the verbatim reproduction in this issue of the clauses from the Act.

Port of London Tax on Coal.

IN the draft schedule of dues that the Port of London Authority are proposing to inflict on goods entering London *viâ* the Thames, is included a tax of 6d. upon coal. If there were any chance of this 6d. becoming an actual and permanent tax upon the London and Suburban Gas Companies whose coal is seaborne, it would be a serious matter, as, at the least, it would probably represent, in the areas of the three Metropolitan Gas Companies alone, a charge upon the gas consumers of between £75,000 and £80,000 a year, assuming no increase in the use of coal for gas making. But there is a likelihood of the proposition being considerably modified, as, in their draft schedule, the Port Authority have considerably exceeded, on a liberal computation, the revenue they will require. According to one of our coal contemporaries, the Authority's needs in respect of revenue will be satisfied in the immediate future by £300,000 a year; while on the coal that arrived in London coastwise in 1907, 6d. per ton levy would have represented two-thirds of that sum. For the three London Gas Companies, excluding the Suburban Companies, to alone have to pay one-fourth of the necessary revenue would be monstrous. That, however is what the proposal as it at present stands amounts to; for, excluding the Brentford, Wandsworth, and other Companies who use the Thames for the conveyance of coal, and taking no account of the oil used for gas manufacture, the consumption of coal by the three London Companies, in the year ending June 30 last, was 3,017,120 tons, which at 6d. per ton would represent £75,428.

The schedule of proposed dues has been circulated among those interested in them for their observations; and, at the end of this month, the Board of Trade will be asked to consider and approve the recommendations made. There should not, therefore, be delay in discussing the matter, and submitting objections. When the Port of London Bill was before the Parliamentary Committee, the Gas Companies concerned, for the purpose of obtaining relief, made representations as to the public service they are rendering, the conditions of which public service are controlled by Parliament. But the Companies' submissions were not received by the Committee in any particularly generous or friendly spirit—in fact, there was no adequate consideration of the Companies' case; and they were referred to the Board of Trade. As we understand the position, the Gas Companies do not desire exemption from all contribution to the improvement and maintenance of the Thames and the Port. But they do think their peculiar position as large and regular importers of coal to London for the purpose of the supply of a public necessity should be taken into consideration, although at the same time they recognize that anything in the way of improving and maintaining the Port that will increase the value and amount of the trade of London, will be indirectly to the advantage of their undertakings. But that

advantage would be dearly bought at 6d. per ton upon the material forming the basis of their manufacture. Any impost of this kind must fall upon the consumers; and among the hundreds of thousands of gas consumers in London are numbered the poorest of the poor and those who, for their very life's sake, have to struggle most severely with the harsh conditions of these more than ordinarily harsh times.

Gas-Fire Economics.

The winter months are fast approaching; and the thoughts of those interested in gas supply naturally turn to the applications of gas that are special to the season. As a matter of fact, there is but one application that is not common to other periods of the year, and that is heating for personal comfort and health. Descriptive articles and advertisements in our pages have already borne witness to the steps taken by some of the leading gas-fire manufacturers to meet in the coming winter the demands of the gas supplier and consumer for efficient and attractive fires. These demands are increasing. Year by year now sees a growth of the gas-fire business. Though last winter in its early months had not as a characteristic any great severity of weather, we know that some of the makers of gas-fires had record sales in this department. And this is an effect that must follow improvement and the suppression of the several causes that have hitherto proved obstructive to obtaining for gas-fires the same rapid popularity as in the case of (say) gas cooking-stoves. Gas-fires have been cheapened; their appearance has been improved. For lower consumption of gas, greater efficiency is realized. Gas of good heating quality, too, is cheaper. And maintenance *in situ* has been rendered so simple, and with simplicity has come economy, that there is now no valid excuse for not hiring-out fires at a paying rental in the same way as cooking-stoves.

The enhancement there has been in the efficiency of gas-fires has been the principal recommendation to greater adoption. In the olden days, we spoke with bated breath of the gas consumption of such fires. Those were the days when crudity had large rule, and when a single inefficient fire would cause a draught on the gas supply of perhaps 40 to 50 cubic feet an hour, and yet would not give nearly so much duty as a fire consuming (say) from 18 to 25 cubic feet an hour in these times. As in gas lighting, so in gas heating, efficiency and consumption have moved in opposite directions; as the one has expanded, the other has receded. For this we have only one descriptive term—that is "progress." The ease, too, of gas and air regulation, the new formation and rearrangement of the incandescing media, the accessibility of every part, and the interchangeability of parts are all eligible for classification under the same term. Viewing these things, we cannot rank ourselves with those who bemoan the slow rate of gas-fire advance, or who gibe at the fire manufacturers for lack of initiative and ambition, and for shambling progress. Such accusations are as untrue as they are uncalled for; and the traducers of the manufacturers' enlightened energy fail to make good their position by pointing to a short cut to greater perfection. We do not claim for the manufacturers the perfect gas-fire; but we do say that, comparing the gas-fire of to-day with its predecessor of but a few years since, there has been excellent advance. It has not been advance by leaps and bounds; it has, in fact, been so gradual that many have been almost insensible to it. But the cumulative effect is remarkable, and, being so, is highly creditable to the manufacturers.

In the gas-fires of this season, there is the testimony to the mutual helpfulness of open discussion of matters in which buyer and seller, user and manufacturer, are concerned. The report upon, and discussion at the last meeting of the Institution of Gas Engineers of, the results of the Leeds University tests have put makers of gas-fires on their mettle in their endeavour to secure the greatest efficiency in the matter of radiant heat. The percentage hitherto realized is not so great as it should be. A certain percentage of the heat units of the gas are required for chimney ventilation; but between this requirement and the heat radiated into a room, there is a margin of a no mean order that is not fully and properly accounted for, and to direct a greater proportion of this to more serviceable use must be the aim of manufacturers. The day of the deep fuel bed of a fire from front to back has departed never to return. The deep fuel bed was wasteful. It invited a strong draught, carrying with it much heat up the chimney. The deeper the bed of fuel from front to back, and the narrower across the front, the greater the obstruction to the radiation of heat into the room. The whole design of the fuel bed and opening was then opposed to the most useful heating effects. But all this has been changed. Long before the results of the Leeds University tests on an open fire were published, the manufacturers had got on to the right track in this regard. The shallow bed, the more open surface, and the nearer approach to the surface of the back fire-brick, were all movements in the right direction, and in favour of a larger proportion of radiant heat being usefully applied to the purpose of domestic heating, although accompanied by greater economy of the gaseous fuel. In the new fires this season are seen the receptivity of the makers, and their willingness to take advantage of suggestion, from whatever quarter it comes, when bearing the impress of practicability. Greater radiating surfaces have been secured by widening or heightening the face area of the fuel; and there is less obstruction to the heat available for radiation from the back of the fuel and fire-brick, by making the fuel cylinders elliptical in section, and thinner and more open in formation on the front side. The indications are encouraging to the gas supply industry lending their aid to the accumulation of improvement in a branch of manufacturing business in which useful achievements are of mutual advantage.

Promoters, Vendors, and Contractors.

We are enabled, in other columns, through the courtesy of Mr. E. H. Stevenson, to throw still more light upon the methods of the people who have in recent years given so much trouble to the gas industry, and by whose methods a certain amount of degradation has been brought upon it, through their joint operations as promoters, vendors, and works contractors, from the notorious centre—99, Cannon Street. The figures now published are very instructive. They show the financial position of the Amman Valley Gas Company at the time the Bill was promoted by and through which it was hoped to get the better of the Ammanford District Council, who—and it is not surprising—had completely lost confidence in the persons who had chief hand in directing the fortunes of the Company. Their direction, as is well known, has ended in disaster and irretrievable loss to the shareholders. The financial statement shows that there is little chance of the preference and ordinary shareholders ever getting back one penny of the money subscribed. A large part of it has been expended without anything tangible existing to represent it. We do not know how much is due to creditors for work done as sub-contractors to that precious Eatonian institution, the Gas and Water Works Supplies and Construction Company, Limited; but we do know from the figures to hand that the public debenture subscription stands at £3980, and also that, through the withdrawal of the Amman Valley Bill (unless there has been a voluntary cancellation), there is still close upon £8000 of debenture stock standing in the names of the vendors and contractors, and as security.

Therefore, whatever the award in the arbitration which is to determine the price to be paid by the Ammanford Company for the derelict works of the Amman Valley Company, the creditors of the latter no doubt will require the whole amount; and the shareholders can do nothing but look on while the spoil, such as it is, is being distributed among others. But had the Company gone on, and received all possible assistance from the District Council, we fail—after examining the financial statement before us, and noting the monstrous dissipation of capital there has been—to see how, under the scheme of that trinity of promoters, vendors, and contractors, a business could have been created in the district that would have brought to the shareholders an atom of consideration in the shape of dividend. The masked cunning there has been through this business is well shown by the fact that Eaton and his associates were willing to have the large appropriations—in the aggregate, upwards of £13,000—in shares and debenture stock cancelled by Parliament to get the Bill through, had other circumstances not intervened. Those appropriations represented almost as much as these people succeeded in drawing from the public—viz., £13,977, made up of £9997 preference and ordinary shares, and £3980 debenture stock; but, unlike the public, their holding of debenture stock preponderated their holding in shares. Of the £13,977 subscribed by the public, nearly one-fourth is entered up in the statement to issue expenses; and payments to the primary contractors for works and plant is seen to have been very

considerable. There is interest in learning the valuation placed upon the executed works and delivered plant by the arbitrator, and to make comparison. Meantime there is a pause in the activities of 99, Cannon Street. Gas company promoting, vending, and works contracting are not running quite so smoothly as the parties chiefly interested could desire; and there are indications that some of the older associates have found convenient places at which to effect a parting of the ways.

Since writing the above, further evidence has come to hand that not only are these professional promoters of feeble gas and water companies with an undue burden of capital being crippled by the loss of public confidence and the disclosures of the unsound character of their undertakings, but that Nemesis is actively pursuing them. We hope Nemesis will soon and effectually overtake them. A circular has been issued by a shareholder (the possessor of £350 in shares) in the Ticehurst and District Water and Gas Company to his fellow victims, asking that a conference may be held to consider their unenviable position, and see whether some concerted action cannot be taken. We are not at liberty to publish the circular, as it is marked "Private and Confi-"dential." But we understand from the communication that the shareholders have not been favoured by the Directors with accounts for the years 1905-8! and when the shareholders do venture to ask for information, they are met by a sphinx-like indifference, and curiosity as to what has become of their money and the prospects of ever handling some return from its foolish speculation is not satisfied. The circular gives a history of the Ticehurst concern, of the several shufflings of the cards that have taken place, and of the repeated extraction of fresh capital from the public, with information as to the names of the men who have played a part in that history. The disclosures in the communication establish, in certain of the transactions, a connection between, 99, Cannon Street, St. Stephen's Chambers, and Tokenhouse Buildings, and between men who have been Directors of Companies to which birth has been given at one or other of these addresses. What the victims of the subtle practices of the prime-movers in certain of these rotten Companies should do is to place their affairs for investigation in the hands of a gas engineer of recognized standing, an accountant with special knowledge of gas and water affairs, and a lawyer; and then consider whether the results warrant further proceedings. The affairs of some of these companies are now in such a position that this is a particularly opportune time for shareholders to press for a complete investigation, and not allow themselves to be further temporized with by soft words, bluff, or bluster.

Miners' Hours and Coal Output.

THE position in the Welsh coal-field is described as a crisis; and there is talk of the owners having reached the limits of their patience. Recriminatory accusations flow freely between masters and men. The owners' feeling is that the men are seeking undue advantages through the Coal Mines (Eight Hours) Act; and the latter assert that the masters are trying to prevent the smooth working of the Act. Our sympathies, taking a disinterested view of the grounds of quarrel, are more with the masters than with the men. The Coal Mines (Eight Hours) Act was conceived, framed, and launched absolutely in the interests of the men; and, on all hands, they have (caring naught for others) been using the instrument effectually for their own ends, and have sought to construe a plain intention in respect of extra hours as best pleases them. The Act is part of the law of the land; and the owners have nothing to gain by anything but its strict observance. In charging the owners with not giving the Act fair play in face of the grasping attitude of the men in several places, is only one way of trying to cause public opinion to saddle the wrong horse in the event of trouble hereafter. But the main point of this reference to the coal position this week is that there is now official recognition, from the side of the men, as to the diminishing effect upon output of the operation of the Act. There has been a decline in production; and "Mabon" (Mr. W. Abraham, M.P.) acknowledges it. In an address to the Rhondda miners the other day, he said it was incorrect and misleading to suggest that the miners' leaders in the discussion on the Eight Hours' Bill had stated that there would be no diminution of output as the result of the passing of the measure. Mr. Abraham's recollection here does not square with our own. During the passing of the measure through Parliament, unlimited ridicule was poured, by the supporters of the Bill, upon those who alleged that the limitation of hours would have an ill-effect upon output. If the miners' immediate leaders had no part in this, they virtually endorsed it by maintaining a silent tongue on the point, and by not amending the "incorrect and misleading" assertions made by their vicarious spokesmen. "Mabon" now declares, however, that what the men's leaders did say, and continued to say, was that, if time were given for the making of the necessary changes consequent upon the curtailment of hours, then the output of coal could be fully maintained. There has been plenty of time given where the Act has come into operation for the making of "necessary" changes; but the "changes" that are causing the trouble are the unnecessary ones. It is remembered at this time that the President of the Board of Trade months ago journeyed to Wales, and told the miners that it was for them to prove to the country that the fears of reduced output and other evils arising from the Act were all ill-founded. The Welsh miners have their own way of following the counsel of their temporary mentor.

The Question of Coal Storage.

There are some matters which, though of the greatest importance to one gas-works, may not apply in the smallest degree to another; but this cannot be said of the question of the storage of coal. Coal must be kept on every works; and the storing of it has given rise to various serious problems. Under these circumstances, no apology to English readers is needed for the lengthy translated summary which appears in to-day's issue of a paper on the subject which was presented at the last meeting of the German Association of Gas and Water Engineers by Herr Prenger, the Manager of the Cologne Gas-Works. It will, of course, be understood that the problems arising are not precisely the same in all cases; and hence care has been taken to deal most fully with those portions of the paper which bear more particularly on storage under conditions which prevail in this country. The origin of Herr Prenger's contribution appears to have been a circular of inquiry which the Council of the German Association deemed it expedient to issue to the managers of a large number of undertakings, in order to collect from them information as to their experience and views on the more important points relating to the handling and storage of gas coal, on which great diversity of opinion had been found to exist. When the replies were received, they were placed in Herr Prenger's hands for collation, with a view to a summary and a report being prepared. It has often been our duty—but under widely different conditions—to condemn the circular of inquiry as a nuisance. That has been when the benefit to be derived was to accrue to a single individual or to a single undertaking. Here, however, the information sought was for the good of the industry as a whole; and so the Association were not only justified in sending round their questions, but are deserving of cordial thanks for having done so. Many particulars of value have in this way been got together which could not possibly have been collected in any other manner.

Investigations in Germany.

The present paper, as is pointed out, does not deal comprehensively with the results of all the inquiries, but is intended rather to draw attention to the diversity of views held and to the importance of obtaining further trustworthy observations on most of the points involved in the question of the storage of gas coal. This seems to promise further details with regard to the investigation at some future time; and should they be forthcoming, they will doubtless prove interesting. Then Dr. Bunte holds out hope of substantial addition to the existing stock of knowledge on the subject; for he stated, in the course of the discussion which took place on the paper, that opportunity had been taken of a meeting a short time before of about forty chemists from various German gas-works to ask them to give special attention to the effect of storage on coal at their own works, with a view to reporting their observations. A number of chemists have agreed to collaborate in making investigations; and by their co-operation, and that of the gas undertakings with which they are connected, it is anticipated that information will be secured for widely varied sets of conditions. By this means, says Dr. Bunte, it should be possible in the course of a year or two to form definite conclusions as to the effect on gas coal of storage under various conditions. Attention has already been given to the question at the Experimental Works

of the Association; but the tests on coal before and after being stored for a given time which were carried out there, referred only to a particular set of conditions. It is unnecessary here to refer to all the points dealt with in Herr Prenger's paper; but his statement may be noted, that the Stettin Gas-Works are about to make provision for storing under water 20,000 tons of English gas coal. From this installation, valuable information is looked for regarding the utility of wet storage when applied to gas coal. Wet coal, the author points out, taken direct from the store, could be carbonized without any difficulty whatever in large chambers and vertical retorts.

Gas Affairs at Bradford.

The report of the Chairman of the Finance and General Purposes Committee to the Bradford City Council on the results of the past year's working of the various undertakings of the Corporation, naturally included some remarks on the Gas Department. Contrary to the customary experience, it appears that there has been a diminished income from gas and residuals amounting to £8000, which, after charging interest and sinking fund, has resulted in a net loss for the year of £5306, as compared with a profit of £3071 for the previous twelve months. This falling off of £8000 in the gas-works and special repairs costing £5000 in the Water Department, practically account for the reduction which was experienced in the net income of all the trading concerns; the total being £21,419 on the present occasion, as against £36,428 a year ago. Under all the circumstances of the case, we are inclined to think that the Chairman was unduly pessimistic in his references to the Corporation's gas undertaking. The markets for coal and for residuals are, of course, outside the control of the management; and traders cannot even be persuaded to use more gas than is absolutely necessary during periods of industrial depression. These matters must be left to right themselves in their own good time. But in so far as it is possible to influence the use of gas by the price at which it is supplied, a cheap rate will be more likely to have this effect than would an increase in the charge. In any event, there is always time to raise the price; and it seems too early to do it after, as the Chairman of the Gas Committee pointed out, the very first year that the undertaking has shown a deficit—after having produced nearly £500,000 for the relief of the city rates. For having performed so signal a service as this to the city, the gas consumers deserve every possible consideration that can be shown them, particularly in times of stress. Such, however, as it is, the deficit is really more a question of figures than of fact; for it is stated that the street lighting costs the Gas Committee some £5000 a year more than the Council pay for it. Let this £5000 be forthwith transferred to the credit of the undertaking, and away goes the ground for suggesting any increase in the price of gas. In dealing with the question, there is one remark of the Chairman of the Finance Committee which is a little difficult to understand—namely, that the gas undertaking should not be obliged to rely upon its bye-products in order to make ends meet. This is rather a new teaching in the industry; and its acceptance would mean a vast alteration in the Bradford gas accounts. The Chairman of the Gas Committee pointed out that the residuals realize between £60,000 and £70,000 a year; and the suggestion that this amount should not be relied upon must mean, if it means anything, that a price must be charged for gas sufficient to meet all expenditure without taking into account in any way the possible returns from residuals. Such a proposal as this is hardly likely to find favour with the Gas Committee—or with the consumers.

National Free Labour Association.

As a somewhat refreshing counterblast to the annual Trades Union Congress, one is accustomed to look to the doings of the National Free Labour Association. The former body does not, as one might be tempted to conclude from the attitude on occasion adopted by it, represent by any means the whole of the labour of the United Kingdom. In fact, the Unions sending delegates to the recent Ipswich Congress number something like 1,700,000 members; whereas the Free Labour Association claim to represent about 700,000 "registered free labour wage-earners, who for most excellent reasons are outside the Trade Union and Socialistic ranks." If the Trades Unions are entitled to all the deference which they regard as due to them, then, also, the large organized body belonging to the "opposition" Association cannot be ignored. More will no doubt be heard of the National Free Labour Association when they hold their seventeenth annual congress next month; but meanwhile the *agenda* is before us, and it shows a striking difference from that of the Ipswich gathering in the number of resolutions to be submitted. There are in all only seven. The first calls for the repeal of the Trade Disputes Act, owing to the "enormous increase of personal assaults by Union pickets during labour disputes." Then there will be proposed a vote of "no confidence" in the Board of Trade Labour Department, and the Conciliation and Arbitration Boards recently created by the Government, on account of "Trades Union bias." By the following resolutions free labour representation is claimed on the proposed Labour Exchanges, the Mines Eight-Hours Act is condemned, confiscatory taxation is denounced, and the danger is pointed out of "Socialists' violent and seditious harangues." The remaining resolution may be quoted, without any comment, as it stands: "That, in the opinion of this Congress, the time has arrived, in the interests of the trade and labour of the country, and for the maintenance of industrial peace, when employers of labour and non-union workers should enter into closer relations for mutual support and assistance, in order to counteract the aggressive action of militant Trade Unionism, whose strike records are black with the foulest deeds of inhumanity, tyranny, and injustice to free labour workers, and whose socialistic legislative proposals, supported by the Government, are a serious injury and an increasing menace to the industries of the country, and to the general public welfare."

A Change of Attitude.

It seems almost impossible to keep abreast of the different phases of South Wales coal trade affairs just at the present time. A week ago, we had to record the fact that the masters had published a circular intimating that in a short time a resolution would be submitted at a meeting of the Coalowners' Association to serve notices on Oct. 1 either on all the workmen employed at all the collieries connected with the Association, or only upon the workmen employed at collieries where the owners are unable to introduce an afternoon shift except by paying a bonus turn. Coming, as it did, on top of numerous other recent disputes, this appeared to augur a determination on the part of the masters to force to an issue the uncomfortable state into which matters in the coalfield generally had drifted. But this reading of the situation is no longer possible. Though there may have been some surprise caused by the coalowners' threat, the astonishment must have been greater when it was announced, at the conclusion of a meeting of the Coalowners' Association on Saturday, that, after considerable discussion, those present had decided to leave the disputed questions to the employers' representatives on the Conciliation Board, to be dealt with in such a manner as they may deem advisable. In the district, a compromise is considered possible on the lines of a surrender by the owners of their objection to the payment of the bonus turn, and a surrender by the men of their objection to the working of the extra hour demanded by the owners under the sixty-hours' clause. In this way, the employers may gain something by their threat to issue notices; but reading between the lines, it is impossible to avoid coming to the conclusion that the true explanation of the present change of attitude is that the employers are not so efficiently organized as the men. From opinions published, it is clear that they are less unanimous than is the case with the miners.

Mr. William Henry Parker, Secretary to the Wakefield Gas Company, who died last July, left estate which has been sworn at £6212 gross and £3766 net.

The Status Prize, instituted by the Council of the Society of Engineers for the best essay on the subject of "How to Improve the Status of Engineers and Engineering, with Special Reference to Consulting Engineers," has this year been awarded to Mr. Allan Thomas. The prize essay will be read before the Society at Caxton Hall, Westminster, on the 4th prox. The prize is to be awarded for five years; this year being the first.

Intimation was received in London last week of the death of Madame Paul Durand, who was designated as "Administrateur Général" of one of our Paris contemporaries—"Le Gaz;" also Editor and Proprietor of the "Annuaire Général des Industries de l'Eclairage, du Chauffage, et de la Force Motrice par le Gaz et l'Electricité." Madame Durand, who was 61 years old, died yesterday week at her residence, Rue Fontaine, and was buried in the Montrouge Cemetery.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 773.)

BUSINESS on the Stock Exchange last week was decidedly quiet; the ordinary slackness of the autumn season having a Jewish holiday on Thursday superadded to it as a sedative. The prevailing tendency taken all round was certainly dull, though relieved at times by buoyancy in speculative lines. The adverse factors were dearer gold, coal-mine apprehensions, poor railway returns, and bad weather. On the opening day, the first of these was felt by Consols, which dropped $\frac{3}{16}$; and even Americans and such like were sensitive and weaker. On Tuesday, weakness proceeded from almost general stagnation, and prices gave way in pretty well every department. Wednesday brought some improvement in things which were susceptible of improving American influence. But outside of this, gilt-edged were weak, Consols fell $\frac{1}{8}$, and Railways were depressed. Thursday was very quiet; but, aided by extreme vivacity in Americans, the tendency was fairly cheerful. Friday brought no increase in business; but the cheerfulness did not altogether die away, and .Railways brightened up quite a bit. On Saturday, matters were little changed; but Consols fell another $\frac{1}{16}$. In the Money Market, there was no cessation to the conditions of extreme ease which have now so long ruled; but the demand for gold made discount terms appreciably harder. In the Gas Market, business well maintained the rate of activity which had characterized the previous week; the two leading issues being well dealt in. The tendency, too, left nothing to be desired in point of buoyancy, and many quotations made further advances, while none receded. In Gaslight and Coke issues, the ordinary was in strong demand and advanced a point, with transactions which steadily rose from 104½ to 106½. The secured issues were quiet and firm. The maximum marked 88⅜ (a rise of 1), the preference 104, and the debenture 86. South Metropolitan was unchanged, marking from 119½ to 120½; and the debenture was done at 85⅜ and 86. In Commercials the 4 per cent. marked 108½ and 109¾; and the 3½ per cent. was a point stronger at 106. Among the Suburban and Provincial group, Brentford old changed hands at 253½ (a rise of 1); and West Ham at 124 and 124½. There were rises of a point in Hastings, Ilford, Lea Bridge, Southampton, and Tottenham; of half-a-point in Newcastle; and of 3 in Sheffield. The Continental companies were very inactive. Imperial was done at from 178⅝ to 180½, Union at 96, ditto preference at 139 and 139½, and Malta at 5⅛. Among the undertakings of the remoter world, Bombay old was done at 5¾ and 5⅞, ditto new at 4 $\frac{15}{16}$, Buenos Ayres debenture at 95¼ (a rise of 1), Cape Town preference at 5⅜ and 5½, Oriental at 139½ and 140, Primitiva at from 7 $\frac{3}{32}$ to 7¼, ditto preference at 5 $\frac{13}{32}$ and 5 $\frac{7}{16}$, River Plate at 16 $\frac{13}{16}$ and 16⅞, and San Paulo preference at 12½.

ELECTRICITY SUPPLY MEMORANDA.

Water-Heating by Electricity—The "Therol" Heater—Constant Electricity Consumption, Inconstant Hot-Water Service—The Problem of Water Heating Still Unsolved—Municipal Trading in Fittings—The "Electrical Contractor" Makes a Humorous Threat—Electrolysis.

ONE of the difficulties the gas industry had to contend with, when cooking by gas became so largely the vogue, was that of providing economically a supply of hot water on tap in lieu of the convenience furnished by the coal kitchen range. This has been successfully overcome, with both convenience and economy to the householder, by the introduction into his water-circulating system of a gas-heated boiler, which can be put into action as and when required, thus obviating the necessity of keeping a coal fire continually and wastefully burning in the kitchen range, or the gas-boiler can be cut out of the circulating system when the coal-range is in use—in this way giving the householder complete liberty in the ways and means of obtaining his hot water supply. These gas-boilers, as well as ventilated geysers, have become very popular in many towns. Our electrical friends have not (being hedged in by all sorts of restrictions) found such a practical way out of the difficulty. The first trouble in the way of success is that one cannot get more out of electrical energy than it contains. Improvements may be made in appliances by which it is used, so that the use may be more economical. But there is a limit to the thermal value of electricity; and the point of that limit is much more restricted than in the case of gas, in relation to the quantity of current and gas purchasable for a given sum. Another difficulty is the design of suitable apparatus for electrical water heating; and a further one is that the liberty of the householder must not be infringed—he must be in the position to get hot water at any temperature at will as in the case of gas heating. The first real step taken in the endeavour to surmount these difficulties has been in the "Therol" water-heater—the invention of Mr. Bell, the Electrical Engineer at Hammersmith. We can congratulate Mr. Bell upon his ingenuity. He has attempted in a practical way a solution of the difficulties; but he has not gone very far in showing how electrical water heating can be made a commercial and domestic success.

Under this invention, the user must, year in year out, morn till night and night till morn, be a constant consumer of electricity—if he wants a supply of hot water. In the size of heater giving an average of 25 gallons of water per day at 110° Fahr., or down to only 9 gallons at boiling-point, the householder must use electricity at the rate of 200 watts per hour, or 4·8 units of electricity per day, which equals 1752 units of electricity per annum! As stated, for this consumption the average daily output of water at 110° Fahr. is 25 gallons; and it is understood that this can be tapped at one time, providing a period has elapsed since hot water was drawn off. This quantity of water, however, will not rise many inches in a domestic bath (say) 5½ feet long and 2 feet wide; and so it seems that only one person of a household will be able to have a limited supply of hot water for a bath each day, and all the other members must wait their day's turn. But should greater quantities of water be drawn off in one day—up to the maximum of 37 gallons at 110°, or 14 gallons at boiling-point—the quantity available next day will be correspondingly reduced. The heater, be it remembered, can only give its full output after one day's continuous storage of energy. Larger sizes of the heater are in course of construction; but what they are going to tot up to in cost and consumption is not yet stated. Now, from the figures given will be seen at a glance the limited quantity of boiling water that will be available to the householder, on an average, per day; and how much he will have to depend upon the generosity of the central station administration as to the price charged for this constant consumption—which will go on wastefully in summer, and be of comparatively little use to him in the winter. We imagine there are few householders who will be prepared to be placed under the bondage of a limit to the supply of hot water, and of compulsory use of electricity at all times to obtain it. It is an indispensable condition that the use of the electricity shall be continuous or electrical water heating is at once placed on the prohibitive side of the hedge for all but millionaires and people of considerable leisure. It is the 100 per cent. constant load that will enable the station engineer to supply the necessary electricity cheaply. The idea has been started that, with this heater, the householder will be able to cut it out during the hours of lighting and use the current for his lamps, or at other periods of the day for a griller, or other purpose, and so have only the expense of one circuit, and the privilege of one price. But however the consumer uses the electricity, his consumption must not be more nor less than that contracted for—that is to say, for the 25-gallon heater 200 watts per hour from Jan. 1 to Dec. 31. The station engineer may appreciate the constant 100 per cent. load; but he will have objections to the loss of the 4d., 5d., or 6d. per unit for the current consumed for private lighting, and only an all-round charge of 0·5d. for the 4·8 units of electricity consumed per hour under the proposed water-heating system. On a schedule of £1 per kilowatt per quarter, *plus* ½d. per unit, the cost of energy would average 0·61d. per unit, or a total of £4 9s. 1d. per annum for an average 25 gallons of hot (110° Fahr.) water per day; and this is "said" to be equivalent to gas at 3s. per 1000 cubic feet. Before this silly statement is further circulated, we advise our electrical friends to study the question of the relative thermal values of gas and electricity, and the high efficiency and capacities of gas-heated boilers and geysers, for giving promptly a supply of water from low to high temperatures without heat storage and continuous use of gas.

Of course, hot water is not constantly required in a household; and the principle underlying this heater is not the storage of hot water but the storage of heat. This, too, is an essential if the householder is not to be kept waiting a considerable time for a supply of hot water. When water is not being used, the portion of the heater storing the heat will be raised to a certain temperature; and the continuous supply of current will maintain it at the given temperature, by affording compensation for the radiation losses. This is an interesting feature, and therefore a description will not be out of place here. Water heating, too, being a branch of business that is being busily cultivated now by gas undertakings, the managers of the commercial departments of those undertakings will be pleased to know something as to the organization of the new competitor in this line. All the electrical papers have been devoting space to more or less laudatory accounts of the new comer. Among them the "Electrician" gives a clear indication of the constitution of the new apparatus; and that is the source of the following description:

> In its simplest form, the apparatus consists of a block of cast iron [elsewhere we learn this weighs, in the 25-gallon size, 2 cwt.] round a coil of pipe. This block is embedded in, and covered with, a layer of magnesia lagging some 2 inches thick. The top of the block is hollowed out into a cylindrical form; and in this hollow is placed the heating element, consisting of four coils of iron wire insulated with mica. The block of iron is then continuously heated by electricity; and water is, when required, passed through the pipe and heated. Further economy is effected by introducing between the lagging and the outer cover a small reservoir, which is in turn protected by lagging from the outermost surface of the heater, and which serves for raising slightly the temperature of the incoming water before it is introduced to the heater proper. Since the coil of pipe through which the water passes must have sufficient surface for heating the water when the block is comparatively cool, it follows that, when the block is very hot, the water will be converted into steam. It is necessary, therefore, to mix the issuing steam with water, and thus reduce it to a suitable temperature. There being no satisfactory valve for the purpose, a special one has been designed, by the use of which it is claimed that a mixture of the steam and water can be completely effected; and the temperature of the mixture adjusted at will. Pipes are brought up from the main and from the hot-water chamber to this mixer, where, by placing the tap in the appropriate position, either cold, tepid, or hot water can be obtained.

From this description, it will be seen that the heater is simple in construction, entirely self-contained, and requires little alteration of any existing pipework when it is installed. Hot water is always available, and by suitably adjusting the tap may be drawn off at any [within the limits already stated] desired temperature. There are no noxious gases or products of combustion, and no flue or chimney is required.

We could hardly expect an electrical contemporary to refer to a matter of this kind without allusion to noxious gases or products of combustion; and, respecting the flue-pipe, as the "Therol" water-heater is priced at £15 15s., between this and the price of a geyser giving considerably more than 25 gallons of boiling—not merely hot—water a day, there is such a big margin of saving in first cost (to say nothing of the saving in the daily expenditure for heating) that the cost of a flue-pipe is of small moment.

Considering the various matters set forth in the preceding paragraphs, no one will be prepared to positively assert that he seriously thinks the "Therol" heater has solved the problem of water heating by electricity; and while the thermal value for a given expenditure is so much less in the case of electricity than in that of gas, the problem of economically heating water by the former agency will indeed be a difficult one to solve. Commercially, no less than in constantly meeting a domestic convenience, there are such marked and insuperable limitations to the employment of electricity for this purpose, that there is confidence in saying that the little burst of elation the electricity industry has felt over the coming of the "Therol" heater will soon fade, and be nothing more than a memory. The history of the electrical industry contains many precedents of this kind.

The question of municipal trading in electrical fittings is agitating the Sheffield Corporation, and promises to do so still more in the future, as a test-case is being worked up between the local contractors and the Corporation—the latter of whom are charged with in this matter exceeding their legal powers. This is the case for which the support of members of the Electrical Contractors' Association has been asked by their organ the "Electrical Contractor." Success is apparently attending the appeal, as in the September issue there is a statement that nearly 100 members guarantee "a very substantial sum" towards the costs. We are on dangerous ground in touching upon this matter, for we see that the editor takes umbrage at our recent reference to the "Electrical Contractor's" "must," in connection with what is described (also in the September issue) as "the Lord's [*sic*] amendment" to the now defunct fittings section of the Electric Lighting Acts (Amendment) Bill. Our friend is sometimes very amusing; and in his anger he is doubly so. On this occasion, he concludes his reference to the "JOURNAL" by this weighty threat: "We will bang the door of this gas journal's editorial sanctum—thereby leaving it in darkness, with another broken mantle." This has not come off yet; so we may anticipate a little fun in our usually serene and serious environment. But we pass from our friend's petulance to the subject in hand—that is, municipal trading in fitting work. Let us make amends, and soothe him with a word of congratulation on what has occurred at Sheffield. The electrical contractors are not without friends in the Council. An attempt was made the other day to get the Council to order departments of the Corporation to give out their electrical work direct to the electrical department instead of inviting tenders. But the proposal did not succeed; on voting a substantial majority rejecting it. The fact, however, that the motion was made shows the narrow spirit engendered and fostered by municipalities (as currently constituted) engaging in trading. Good local government demands recognition of the system of tendering for public work, and acceptance of tenders without fear or favour.

The question of electrolysis comes before us spasmodically. An instance of serious trouble has travelled from Winnipeg; and, as in this case the source of the mischief has been proved, a secondary serious question is, Who is liable for the damage that has been done? The water-mains and telephone cables are the sufferers; and the Winnipeg Electric Railway Company's system is in fault. The water-mains have been well perforated; and all through inefficient and broken-down bonding of the rails of the tramway system. To connect the rails, bonds were used of No. 0 B and S copper wire, having a resistance equivalent to from 20 to 60 feet of the rails used, which vary in weight from 70 lbs. to 95 lbs. per yard. A copper cable, 0·5 square inch in area, is laid between the rails; and this is cross-bonded to the track at intervals. It was found on examination that many of the track-bonds were broken; and in these places current escaped to the water-pipes. The remedy has been the rebonding of the rails in a more effective manner; but this does not remedy the damage to the water-mains and other underground property.

Wales and Monmouthshire District Institution of Gas Engineers and Managers.—The autumn meeting of the Institution will take place in the Royal Gate House Hotel Assembly Rooms at Tenby, on Wednesday, the 29th inst. The new President (Mr. A. H. Brookman) will deliver his Inaugural Address; and he will afterwards give a description of the Tenby Gas-Works. There will also be a discussion on "Some Points of Gas-Works Economy," which will be opened by Mr. J. H. Canning, of Newport (Mon.). At the conclusion of the meeting, the company will take luncheon in the hotel, on the invitation of the Chairman and Directors of the Tenby Gas Consumers' Company. Afterwards, members will visit the gas-works or the various places of interest in the neighbourhood.

GAS ACTS FOR 1909.

THE gas measures for the session still unterminated, in the form in which they have received the Royal Assent, are now before us; and this week we commence a review of their principal provisions, pointing out at the same time the clauses in which, being main ones, changes have occurred. The successful measures of the Companies who sought incorporation and statutory powers are first noticed. There were half-a-dozen of these Bills introduced; but the Amman Valley Company having fortunately been condemned to extinction, the Lisburn Company having agreed to part with their works to the Local Authority, and the Biddulph, Bradley Green, and Black Bull Company having withdrawn their Bill, only three measures in this group are left for review.

Surrounding the Ammanford Act, there is great interest, inasmuch as the Company that is formed under it will absorb the derelict works of the Amman Valley Gas Company, which has the reputation of being one of the launchings of the 99, Cannon Street promoting coterie headed by Edmund Eaton. The Amman Valley Company originally promoted a Bill; but the prime-movers found very good reasons for coming to an agreement with those who were backing the Ammanford measure, and for arranging as to the transfer of the property, and the withdrawal of the Amman Valley Gas Bill. But this, it will be remembered, did not prevent Mr. E. H. Stevenson and Mr. Baker (the Parliamentary Agent for the Ammanford Bill) speaking their minds, before the members of the Unopposed Bills Committee of the Commons, on the subject of the promotion of the Amman Valley Company and the position of the deluded shareholders. From the preamble of the Ammanford Act now before us, the history of the Amman Valley Company has been deleted. But it will stand on record in our pages for Jan. 5 last, with a supplement in this issue. The new Company authorized under the Ammanford Act will purchase the Amman Valley concern by arbitration; and will conduct the gas supply within the urban district of Ammanford and the parish of Llandebie in the county of Carmarthen. The arbitration is to be by a single arbitrator nominated by the Board of Trade. Originally it was proposed to allocate shares in the Ammanford Company to the Amman Valley shareholders; now it is to be a purchase outright, at a fair price for the works, so that the concern shall not be capital-logged. The capital of the Company is to be £18,000 in £1 shares, with one-third borrowing powers. The maximum rate of dividend is to be 8 per cent. A reserve fund up to one-tenth of the paid-up capital is prescribed; and power is given to create a special purposes fund. With regard to excess profits, the amount allowed to be carried forward is not to exceed the sum required to pay the maximum dividend for one year on the paid-up capital. In the clauses giving protection to the District Council, it is enacted that the Company are not to open a greater continuous length of street than 100 yards, nor leave a less space than 50 yards between any two consecutive openings, nor are they to open a greater length of street than 50 yards at any place where only one cart can pass at the side, or more than 100 yards where only two carts can pass at the same time. In the application of the provisions of the Gas-Works Clauses Act, 1847, with respect to the breaking-up of streets for the purpose of laying pipes, the notice required by section 8 of the Act is not to be less than seven days, instead of three days; but this provision is not to apply in cases of emergency. By another provision, it is decreed—

The Company shall not manufacture or supply gas from, or by means of, the existing gas-works, mains, and other works of the Limited Company to be acquired by the Company under this Act, unless and until such works shall, at the expense of the Company, have been inspected by an engineer to be agreed by the Council and the Company, or, failing agreement, to be appointed by the President of the Institution of Civil Engineers, on the application of either party, and such works of repair or other works as he may deem necessary have been executed to his satisfaction, and the Company produce to the Council the certificate of such engineer that the said works are in all respects fit and proper for the manufacture of gas.

The maximum price for gas is placed at 4s. 3d. per 1000 cubic feet; in the Bill the standard price was 3s. 9d., with sliding-scale. The illuminating standard for the gas is 14 candles, tested by the "Metropolitan" No. 2 burner. Power is given to the District Council to purchase the undertaking after 21 years from the passing of the Act without opposition from the Company. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Act of the Blackwood Gas Company defines in detail the limits of supply in the urban districts of Mynyddislwyn and Bedwellty. When noticing the Bill, historical information was given concerning the Company. The capital is to be £30,000, whereof £7500 is to represent the original capital, and £22,500 the additional capital, of which not more than £10,000 is to be raised as preference stock or shares. Borrowing powers are granted at the usual one-third rate. The new auction clause is applied to the stock and shares. The original capital is to be entitled to a maximum dividend of 10 per cent.; the additional capital to one of 7 per cent.; while the preference capital is to receive 6 per cent. The special purposes fund clause is adopted. The carry-forward is limited to an amount equal to a year's dividend. The price of gas is not to exceed 5s. per 1000 cubic feet within a radius of 1 mile from the gas-works lands, and 5s. 6d. beyond; while the price to be charged for gas supplied for public lighting is not to

exceed 4s. 6d. and 5s. respectively. The ordinary prepayment meter clauses are inserted. Regarding illuminating power, the standard is to be 14 candles, tested by the "Metropolitan" No. 2 burner. A purchase clause is inserted, operative within twelve months after the expiration of 20 years from the passing of the Act. [*Parliamentary Agents: Messrs. Lees and Co.*]

In the Littlehampton Gas Act, the extended limits of the Company are defined. The capital authorized is £59,025, which is a drop of £15,000 since the Bill was introduced. Of the total authorization, £5300 is to be called "A" ordinary shares, £23,725 "B" ordinary shares, and £30,000 "C" ordinary shares. The "A" shares are to be divided among, and vested in, the several persons who, before the passing of the Act, were registered as holders of 1060 shares issued under the authority of the Order of 1875 in proportion to the amount of shares held by them. Similarly the "B" shares will be divided among the holders of 4745 shares issued under the Orders of 1888 and 1900. The "C" capital represents the new additional, of which not more than £10,000 is to be issued as preference. The standard dividends on the three classes of shares are 10, 7, and 5 per cent. respectively. A special purposes fund is authorized, as well as a reserve fund. The revenue carry-forward is not to exceed the amount required to pay a year's dividend at the authorized rate. The new auction clause is applied. As to borrowing powers, the Company are allowed to borrow £9650 (including £7100 already borrowed) in respect of the original capital, and £10,000 in respect of the additional capital. Land is scheduled for manufacturing works. The standard price of gas is to be 4s. 3d. per 1000 cubic feet, except within Angmering, Kingston, and Ferring, in which areas the price is to be 6d. in excess of the price for the time being charged within the remaining parts of the limit of supply (4s. 9d. in respect of the latter districts was mentioned in the Bill). Under the sliding-scale, changes of 1d. in price will vary the dividend by 5s. per cent. on the "A" and "B" shares, and by 2s. 6d. on the "C" shares. The ordinary prepayment meter clause appears. The illuminating standard of the gas is to be 15 candles, tested by the "Metropolitan" No. 2 burner. The 10 and 15 per cent. discounts clause stands as part of the measure. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

We also commence the review of the new powers obtained by Gas Companies previously under statutory authority.

It is a substantial Act of which the Aldershot Gas and Water Company have become possessed. Gas and electricity supply powers form the greater part of it. In regard to the supply of the former, the extension sought of the limits of supply has been allowed. In connection with these extensions, the agreements with the Hartley Wintney and Odiham Gas Companies for the purchase of their property have been confirmed. The settled consideration in the former case, other than for stocks and stores, is £3000; and the transfer is to take place on Sept. 29. The same date is fixed for the transfer of the Odiham Company, to whom the sum of £1600 is to be paid. Within the extended limits of supply, the price of gas is never to be more than 1s. 6d., or, for a period of seven years from the passing of the Act, less than 1s. per 1000 cubic feet, in excess of the price for the time being charged within Aldershot. There was a section in the Bill which proposed, in the words of the side heading, to give the Company power, notwithstanding section 27 of the Order of 1903, to supply gas in the Yorktown district; but, in its place, there now stands a section which repeals so much of the North Camp Order of 1877, the Order of 1890, and the Act of 1896, as authorizes the Company to supply gas in, or for use within, the limits within which the Yorktown and Blackwater Gas Company are authorized to supply. Authority is given relative to the construction and maintenance of works on scheduled lands. The Company have secured the right to supply power gas, and in regard thereto have exemption from the conditions under which they supply ordinary gas in respect of power, pressure, purity, testing, and price:

Provided that the Company shall not enter into any agreement for the supply of power gas save on such terms as, having regard to the circumstances of the supply contemplated by the agreement, shall secure as far as is reasonably practicable that the receipts on revenue account shall cover the expenditure on such account and interest on the capital outlay involved at the rate of 7 per cent. per annum: Provided further, that the Company shall not, without the previous consent in writing of the Aldershot Council, under the hand of their Clerk, lay any mains for the supply of power gas in Aldershot, except in the portion of Ash Road between Ash Bridge and the junction of North Lane with Ash Road, and in the portion of North Lane between such junction and the entrance from North Lane to the Company's gas-works.

All the usual regulating and penalizing provisions as to power gas supply are included in the measure. The power under the 1882 Act of the Ascot District Gas and Electricity Company to supply gas in Ash is repealed. The clauses referring to the supply of electricity within specified limits have been extended by certain conditions affecting the territory concerned. The limits include the parishes of Farnborough, Fleet, Cove, Crookham, Hawley-with-Minley, Yateley, and Frimley (to the extent not comprised within the limits for the supply of gas of the Yorktown and Blackwater Company), as well as Ash and Seale. There is a stipulation that the Company are not to supply within any part of Frimley unless either the Frimley Urban District Council shall have given their consent thereto under their common seal, or a period of one year from the passing of the Act shall have elapsed without the Council having obtained powers authorizing them to supply electricity. And the Board of Trade, in granting any Provisional Order to the Council, may, by such Order, revoke or modify the Company's powers of electrical supply within the parish and urban district. The powers of supply are to cease in the parishes of Ash and Seale if not exercised within five years. Land is scheduled for generating-stations; but in respect of other land now belonging to the Company, it may be appropriated and used for the same purpose with the consent of the Board of Trade, but only after notice has been given by advertisement, or otherwise as the Board may direct, to the owners and lessees of lands situate within 300 yards of the land upon which the generating station is to be constructed, and an opportunity has been given to those owners and lessees of stating any objection they may have thereto. In a section giving power to make agreements for the supply of electrical energy to local authorities, &c., the Company are debarred from exercising the powers conferred by the section within the authorized area of supply of the Yorktown and Blackwater Company or of the Ascot District Gas and Electricity Company without getting the previous consent of those Companies. The Company are to lay their cables in both Frimley and Farnborough within two years of the powers coming into force, and in Fleet within three years of the passing of the Act, but certain extensions of these periods are within the discretion of the Board of Trade. The Company are protected in the matter of stand-by electricity supplies where there is a separate supply, unless the consumer shall have "previously agreed to pay to the Company such minimum sum as will give to the Company a reasonable return on the capital expenditure and other standing charges incurred by the Company to meet the possible maximum demand of such person." The Company are not to supply energy to any Company, person, or Government department either in Aldershot or for use in Aldershot. The name of the Company is to be changed to the Aldershot Gas, Water, and District Lighting Company. The capital is to be consolidated on the lines sketched in our issue for Jan. 12 last—the "A" stock carrying a standard dividend of 5 per cent., the "B" stock 3½ per cent., the "C" stock 5 per cent., and the preference stock 4 per cent. As heretofore, the standard price is to be 3s. 8d. per 1000 cubic feet—the sliding-scale to apply half-yearly with 9d. per cent. variation in dividend for every 1d. change in price. The additional capital is fixed at £200,000 of "C" consolidated stock. New issues of stock may be offered to consumers and employees; and to sales by auction or tender, the new form of clause applies. The borrowing powers are to equal one-third part of the amount of the additional capital raised under the powers of the Act. Authority is taken to form a special purposes fund. Authorization is given to the construction of a tramroad in connection with the Company's existing one The clauses affecting this have been considerably extended since the Bill was introduced. Reference was made last week (p. 681) to a clause regarding pipe-depths in the county of Surrey. [*Parliamentary Agents: Messrs. Blyth, Dutton, Hartley, and Blyth.*]

PARLIAMENTARY MUNICIPAL TRADING RETURN.

Another instalment was issued last week of the return regarding municipal trading in the United Kingdom which is being prepared on the initiation of Mr. Chiozza Money, the Member for North Paddington. Nearly three years have elapsed since the return was moved for; and even yet there are several parts still to come. The present volume deals with such of the municipal boroughs specified in the resolution of the House of Commons as are situate in the geographical counties of Lancaster and Chester—namely, Liverpool, Manchester, Salford, Bolton, Oldham, Blackburn, Preston, Birkenhead, Burnley, Stockport, and Blackpool.

The volumes are not being issued in order of number; for Parts I. and VI. were noticed in the "Journal" for June 22 last, while the present one is Part II. As already explained, the return is intended to show trading statistics for the London County Council, the Corporation of the City of London, the Council of each Metropolitan Borough, the Corporations of the Municipal Boroughs of Liverpool, Manchester, Birmingham, Leeds, Sheffield, Bristol, Bradford, West Ham, Newcastle-upon-Tyne, Kingston-upon-Hull, Nottingham, Salford, Leicester, Portsmouth, Bolton, Cardiff, Sunderland, Oldham, Croydon, Blackburn, Brighton, Derby, Preston, Norwich, Birkenhead, Gateshead, Plymouth, Halifax, Southampton, South Shields, Burnley, East Ham, Huddersfield, Swansea, Wolverhampton, Stockport, Middlesbrough, Stockton-on-Tees, and Blackpool, and the Corporations of Edinburgh, Glasgow, Dundee, and Aberdeen. It is to indicate the nature and extent and, for each of the last four years for which figures are available, the financial results of reproductive municipal undertakings—including, for each undertaking separately, a short description thereof, date and terms of original acquisition, or establishment or subsequent extension, how managed, capital employed and how obtained, value of the undertaking, capital paid off and outstanding, loan charges, provision for depreciation, gross income and expenditure, net profit or loss, how profit is allocated or loss met, amount of relief or burden to rates, number and salaries of the chief paid officials, number of workpeople, rate of wages paid in chief classes of labour, and

prices charged for products or services supplied or rendered. As a matter of fact, the boroughs mentioned above are all those which in 1901 had a population of upwards of 90,000, with the addition of two smaller ones—Stockton-on-Tees and Blackpool. The form in which the information has been asked for and supplied was explained when noticing the earlier issued parts; and it is therefore unnecessary to repeat it here.

Of the eleven boroughs comprised in the instalment now under notice, the number of reproductive undertakings with regard to which statistics fall to be included are for Liverpool six, Manchester seven, Salford seven, Bolton seven, Oldham seven, Blackburn six, Preston five, Birkenhead eight, Burnley nine, Stockport six, and Blackpool five. Liverpool and Preston are, of course, the only two cases in which the undertakings do not embrace gas-works; while in all but one instance—that of Blackpool—is water supply included. Even Blackpool has a sea-water supply undertaking, the deficiency in revenue from which had been met by a charge on a general district rate. Ten of the boroughs have electricity works—the omission being Preston; and all have tramways, as well as markets. Ten have baths; and four, working-class dwellings. Then there are a few undertakings of a miscellaneous character. For instance, Bolton and Burnley have cemeteries; while in Oldham flagmaking is carried on. At Preston there is the Ribble Navigation; and at Birkenhead, ferries. Burnley also possesses cold-air stores and a sterilized milk depôt.

During the four years mentioned in the return—1903-4-5-6—the Liverpool rates received about £67,000 from the electricity undertaking, £110,000 from the tramways, and £68,000 from markets. In Manchester, the gas undertaking contributed some £230,000, the tramways £172,000, and the markets £52,000. Salford similarly benefited from the water-works to the extent of £14,500, the gas-works £105,000, the electricity works £16,000, the tramways £48,000, and the markets £147. At Bolton, the water-works have handed over to the rates £45,000, the gas-works £78,000, the electrical undertaking £23,000, the tramways £15,000, and the markets £7000. The Oldham water-works have contributed £6000 (all in the year 1903-4), the gas-works £32,000, the electrical undertaking £1000 (all in the year 1903-4), and the markets £9000. The Blackburn markets have handed over £18,000; and the Preston markets, £10,000. At Birkenhead, the water-works contributed £12,000, the gas-works £34,000, and the ferries £3500 (all in the year 1902-3). At Burnley, the rates have benefited by £500 from the water-works, £40,000 from the gas-works, £12,000 from the electrical undertaking, £4000 from the markets, and £1000 from the cold-air stores. The Stockport gas-works have given for the same purpose £39,000, the electrical undertaking £1000 (all in the year 1905-6), the tramways £2500 (all in the year 1905-6), and the markets £600. At Blackpool, the gas-works have handed over £61,000, the electricity undertaking £10,000, the tramways £10,000, the markets £1400.

It is impossible to deal more fully here with the enormous amount of matter and multifarious tables of which the volume is constituted; but from the brief particulars given, it will be seen that out of the seventy-three "reproductive" undertakings owned by the eleven boroughs whose returns fall to be included, only some thirty-eight are stated to have contributed any sum over the four years mentioned—that is, 1902-3 to 1905-6—towards the relief of the rates. Gas, of course, comes easily first, with a total of £619,000, more than one-third of which falls under the head of Manchester. Next in order are tramways, with £358,000, then markets £183,000, electricity £130,000, and water £78,000. The remaining two items—one case each—are ferries £3500, and cold-air stores £1000. Some of the undertakings, it need hardly be pointed out, have been brought into being for sanitary reasons, and not really as trading concerns. Under this head may perhaps be included workmen's dwellings, baths, cemeteries, and the sterilized milk depôt. Water-works might also to a large extent be classed among the undertakings whose main object is to minister to the health of the citizens—though it is true that in very many cases a plentiful and wholesome supply of water has owed its origin to private enterprise, and not to the efforts of local governing bodies. Many of the concerns not being, therefore, primarily profit-earning, no good purpose would be served by detailing the deficiences incurred in different directions.

Well, then, as a result of the dip into the parliamentary return we see that in four years seventy-three "reproductive" undertakings contributed a total of about £1,372,500 in aid of the rates of eleven boroughs, nearly one-half of which came from eight gas undertakings. For the amount of capital which has produced this result, inquirers must be referred to the volume itself. The task of adding it up is too big a one for us to undertake just now.

While referring to so large an extent to the profits made on municipal trading concerns, and handed over to the rates, it must not be assumed that we regard this as any adequate test of the success or otherwise of such enterprises. The relief of the general body of ratepayers at the expense of a particular section of consumers or customers, has times out of number been deprecated in these pages. This aspect of the matter has merely been taken as probably the most popular feature of the return—and one which it was no doubt largely designed to bring out.

In leaving the volume, the hope may, with all respect, be expressed that it will prove of good use both to the Honourable Member on whose initiation it and the remainder of the series are being prepared and also to the numerous other statistically-minded students of the vexed subject of municipal trading.

TECHNOLOGY AS EXEMPLIFIED BY THE ST. HELENS RETORTS.

By Thomas Holgate, F.C.S., M.Inst.C.E.

At the recent meeting of the Institution of Gas Engineers, more than one speaker expressed the idea that our conceptions as to carbonizing are at present in a state of flux, and that while the newer methods of working had thrown light in some directions, they had darkened others. The actions that take place inside a retort, vertical or horizontal, are admittedly so complicated that he is wise who is content to accumulate facts as extensively as possible before attempting to generalize upon the subject. But this operation of gathering facts is not without difficulty; and the careful student is often at a loss to know what is the exact interpretation to be put upon the data placed before him. The incompleteness and lack of system which characterize the returns, in many cases make it impossible to arrive at all-round facts that are convincing; and too often this difficulty must be the accepted explanation why so many engineers are chary in considering any departure from ordinary methods of gas making. To endeavour to obtain such facts is the object of the following investigation into a system which has results duly accredited by more than one experimentalist. But if any lessons towards the co-ordination of results of working be deduced therefrom, it is hoped they will be

Table I.—*Tests in Vertical Retorts.*

—	Test by Mr. J. E. Blundell.	Test by Dr. H. G. Colman.	Test by Dr. H. G. Colman.	Test by Mr. J. E. Blundell.	Line No.
Class of coal used	Washed nuts	Washed nuts	Un-screened	Washed slack and washed Arley slack	
Origin of coal	Orrell, near Wigan	Orrell, near Wigan	Thornley, Durham		
Percentage of moisture in coal	5·35	3·95	1·08	..	1
Percentage of ash in coal	..	6·94	3·24	..	2
,, ,, coal substance	..	89·11	95·68	..	3
Cubic feet of gas per ton of coal (at 60° Fahr. and 30 in. bar.)	11,779 (*a*)	11,448	13,102	11,551 (*b*)	4
Illuminating power per cubic foot in No. 2 Metropolitan burner	3·148	3·256	3·112	3·346	5
Illuminating power in candles per ton of coal	37,080	37,274	40,773	38,650	6
Observed calorific value per cubic foot in B.Th.U. gross	600·25	588·8	573·6	592·67	7
Ditto net	541·94	529·6	514·5	542·50	8
Ditto difference	58·31	59·2	59·1	50·17	9
Observed calorific value per ton of coal gross	7,070,344	6,740,582	7,515,307	6,845,931	10
Ditto net	6,383,511	6,062,860	6,740,979	6,266,417	11
Ditto difference	686,833	677,722	774,328	579,514	12
Coke produced per ton of coal in pounds	1606·08(*c*)	dry 1590·4	dry 1590·4	Not given	13
Ammoniacal liquor produced per ton of coal, in gallons, 10-oz. strength	40·76	39·6	31·7	,, ,,	14
Ditto in pounds	418·00	405·9	324·9	,, ,,	15
Tar in gallons	16·00	17·2	13·3(*d*)	,, ,,	16
,, in pounds	not given	185·1	148·8	,, ,,	17
Total of solid and liquid products per ton in pounds	2196	2181	2064	,, ,,	18
Gross observed calorific value per ton of dry coal	7,469,988	7,017,784	7,597,358	..	19
Net observed calorific value per ton of dry coal	6,744,331	6,312,191	6,814,576	..	20
Net observed calorific value per ton of coal substance	..	6,803,793	7,045,337	..	21
Gross observed calorific value per ton of coal substance	..	7,564,338	7,854,627	..	22
Crystallized sodium ferrocyanide per ton of coal, pounds	..	5 5	5·3	..	23
Sulphur in gas purified with oxide, grains per 100 cubic feet	..	37·5	20·8	..	24

(*a*) Certified by Mr. Blundell that a similar coal distilled in horizontal retorts gave 10,510 cubic feet per ton, illuminating and calorific values not stated. (*b*) Ditto about 10,000 cubic feet. (*c*) Not stated whether dry or moist. (*d*) On page 166 of the "Journal" for July 20, 1909, this figure is given as 12·3; but the total yield (795 gallons) from 59·75 tons of coal works out to 13·3 gallons.

of general application, and not as a judgment upon the systems of carbonizing immediately concerned. On the contrary, Messrs. Samuel Glover and John West are to be congratulated upon the good work they have done for the gas industry, and upon the readiness with which they have placed the results of tests at the service of the profession. From these tests, published in the "JOURNAL" for the 8th of June (p. 635) and for the 20th of July (p. 166), the following figures have been culled or calculated by the writer; and they show what further particulars are required before one can make a definite affirmation as to the results the St. Helens vertical retorts are capable of yielding.

Probably the best method of examination to follow will be, firstly, to set out upon a common basis the data available; secondly, to form a balance-sheet for each ton of coal; and, thirdly, to dissect each item that forms the balance-sheet, and see how far it is supported by collateral evidence.

BALANCE-SHEET CONSIDERATIONS.

Of the tests in Table I. it is only possible to make out a balance-sheet for those in columns 1, 2, and 3. For column 4 there is no analysis of gas, and other details are lacking; while for the horizontal retorts absolutely no comparison can be made. The data for column 1 are incomplete; but an approximate result can be attempted. As to this test, it is not stated whether the weight of coke recorded was for the moist or dry condition; but if it represents moist, and we assume 4 per cent. of water, as was found in test No. 2, then it would be proper to deduct 64 lbs. from the apparent surplus shown in the Table II. The specific gravity of the tar in this test is not given; but in No. 2 test it was 1·076 and in No. 3 test 1·119. If we take the lower figure, equal to 10·76 lbs. per gallon, we obtain for the 16 gallons 172·16 lbs. as in Table II. For none of the tests is it stated how much water was added in the scrubbers or washers to remove the last traces of ammonia; but if we assume the normal figure of 10 gallons per ton, we must deduct 100 lbs. from the figures of Table I. to give those of Table II.

TABLE II.—*Weight of Products Returned per Ton of Coal Distilled.*

Column in Table I.	1	2	3
Density of gas computed from analyses (hydrogen = unity)	5·7745	5·8735	5·42335
Weight of gas from one ton of coal, pounds	361·92	357·78	378·10
,, coke ,, ,, ,, ,,	1606 08	1590·40	1590·40
,, ammoniacal liquor ,, ,,	318·00	305·90	224·90
,, tar ,, ,, ,, ,,	172·16	185·07	148·80
,, products ,, ,, ,,	2458·16	2439·15	2342·20
Apparent surplus ,, ,, ,, ,,	218·16	199·15	102·20
Weight of tar per ton of coal substance, in pounds	..	207·69	155·52
Weight of gas, do.,	..	401·50	395·10

This comparison brings out some valuable information. Firstly, that the products declared in each test exceed the weight of material employed—ranging in excess from 4½ to nearly 10 per cent.; and as we are told that no steam was admitted to the retorts, and that scarcely any water gas was produced from the seals at the coke chamber, we are left in doubt as to the origin of the apparent surplus. It is worthy of note that the latest test (No. 3) shows only about one-half the surplus of the earlier ones. There is a falling off in ammoniacal liquor, which, however, is almost accounted for by the reduced percentage of moisture in the coal, and so does not help to clear up the discrepancy. The falling off in weight of tar is not easily intelligible, especially as the coal used contained less ash as well as less moisture. The disparity is best seen by comparing the weight of tar produced per ton of coal substance. Secondly, that though the volumes of gas produced in tests Nos. 2 and 3 were respectively, 11,448 and 13,102 cubic feet, yet the weight thereof per ton of bulk coal varied only from 358 lbs. to 378 lbs.; the 14·5 per cent. increase of volume being coincident with an increase of only 5·6 per cent. by weight, while per ton of coal substance the figures become 12,847 cubic feet and 13,693 cubic feet respectively, and for weight of gas the order of magnitude becomes reversed—viz., 401·5 lbs. and 395·1 lbs. respectively. Thirdly, along with Table I. line 22, we see that, despite the adverse influence of the excess moisture and ash in the coal of test No. 2, the gross calorific value per ton of coal substance was but 3·8 per cent. less; while the illuminating value of the gas was only 1·6 per cent. less—41,829 and 42,614 candles respectively. Further, as the figures refer to the illuminating power, when the carbonic acid is left in the gas it is desirable to know what would have been the result if it had been eliminated. The illuminating powers per cubic foot would have become probably 3·532 and 3·252 respectively, giving per ton of coal substance 45,375 and 44,529 candles respectively, or nearly 2 per cent. in favour of the coal substance of the Orrell nuts. The figures available are not sufficient for definite conclusions, but with a calorific value (gross) of 3·8 per cent. in favour of the Durham coal substance, and with an illuminating value of 1·9 per cent. against it, there is not a wide disparity under distillation. There is, however, the indication of the possibility of dry, clean Arley coal proving as good as, if not better than, Thornley coal, and with that would come a higher yield of gas in the St. Helens verticals, because it could be utilized fresh from the local collieries. Fourthly, the weight of coke produced appears high, but there are no means of estimating how much it is in excess of the true value. It would have been an advantage if the percentage of ash in the coke had been given and also a determination of the volatile matter remaining, if any. Fifthly, the weight of gas given in Table II. has been computed from the analyses; but test No. 2 is the only case where more than one analysis is given. So that some uncertainty must exist as to the weights given, due partly to this cause and partly to another—the density of the unsaturated hydrocarbons—that will appear in the succeeding section of this article.

ANALYSES.

Lines 7, 8, and 9 of Table I. contain the observed calorific values of the gases in the several tests, and the figures for Nos. 1, 2, and 3 show a uniformity in the difference figures, 58·3, 59·2, 59·1, which is noteworthy in contrast with that of test No. 4, which is 50·17. The last-named is unusual for a coal gas of the gross calorific value 592; and it would have been useful to have been able to check it by an analysis of the chemical compositions. As the published results do not contain such data for No. 4, we must be content to see what the analyses given for Nos. 1, 2, and 3 have to convey as to the calorific values thereof. They raise questions that concern the validity of the data set forth in Table I., and cannot therefore be ignored.

TABLE III.—*Comparison of Analyses of Gas Made in Vertical Retorts at St. Helen's.*

Test, Column in Table I.	1.	2.	3.
Analyst	J. E. Blundell	H. G. Colman	H. G. Colman
Which analysis here given	The only one	Average of three	An average, the only one given
Methane	32·57	31·97	29·05
Hydrogen	50 94	50·67	54·70
Carbon monoxide	7 20	9·90	8·70
Simple combustibles	91·71	92·54	92·45
Complex combustibles, C_nH_m	2·80	2·70	2·85
Total combustibles	94·51	95·24	95·30
Oxygen	0·00	0·00	0·05
Nitrogen	3·49	2·73	3·20
Carbon dioxide	2·00	1·97	1·00
Total accounted for	100·00	99·94	99·55
Ratio of total hydrocarbon volume to hydrogen volume	0·714	0·684	0·583
Illuminating power of gas, containing CO_2, per cubic foot in the No. 2 "Metropolitan" burner—corresponding to the above analysis	3·148	3·274	3·112
ditto ditto CO_2 out	3·428	3·550	3·252
Observed calorific values, corresponding to the analyses in B.Th.U. per cubic foot—			
Gross	600·25	587·93	573·6
Net	541·94	531·97	514·5
Difference	58·31	55·96	59·1

TABLE IV.—*Values Calculated from Analysis.*

Test No. 1 (Mr. J. E. Blundell).	Gross.	Net.	Difference.
Methane 1008–902 B.Th.U.	338·38	302·80	35·58
Hydrogen 325–272 ,,	165·55	138·56	27·01
Carbon monoxide 323 ,,	23·25	23·25	0·00
Simple combustibles ,,	527·20	464·61	62·59
C_nH_m by difference ,,	73·05	77·33	+ 4·28*
Observed values ,,	600·25	541·94	58·31
C_nH_m per cubic foot calculated from the above C_nH_m by difference	2609	2762	+ 153

How far the number of tests made is adequate cannot be discussed, because only in test No. 2 is more than one recorded. But it is important to notice that in Table III., test No. 2, the figures are the average of three analyses, each one of which is discussed in detail later. The observed calorific values given in Table III. correspond to these analyses, while the observed calorific values in Table I. are the averages of eight sets of observations. No serious difference occurs in the gross value between these two sets of figures, but there does in the case of the net values. Correcting some minor errors of computation in the original report, the following are the averages of the eight sets: Illuminating power with CO_2 in, 3·255 candles per cubic foot; calorific values, 588·09, 529·55, 58·54 gross, net, and difference respectively. Why the observed net value should be higher in Table III. than in Table I. is probably explained by an abnormal observation result—viz., that designated No. (3) on p. 636 of the "JOURNAL," June 8, where the gas is recorded 594 gross, 542·9 net, and the difference the abnormal 51·1. That this is in need of explanation will be apparent from a detailed examination of the analysis of this sample that follows (see Tables V. and VI.).

Table IV. shows us that the calorific values observed in Test No. 1 and those computed from the analysis are at variance, for

the difference figure of 58·31 observed is less than that which is due to the simple combustibles alone. There is no serious incompatibility between the gross values observed and computed; but the net figures are quite out of joint, and consequently the difference figure for the complex combustibles is completely reversed in sign. The simplest assumption of the cause of the discrepancy is that the condensed water from the calorimeter has been in some way underestimated. If, then, we accept the observed value for the gross to be correct, what should be assigned as the net value? We cannot, without further data, say definitely, but from analogy can indicate an approximate figure. From other sources, there is reason for believing that the complex combustibles from vertical retorts continuously charged average that of an olefine. On these lines, the C_nH_m would be $C_{3\cdot28}H_{6\cdot56}$, having per cubic foot gross, net, and difference respectively of 2607·6, 2433·76, 173·84 B.Th.U., equal for the 2·8 per cent. by volume to 73·013, 68·145, 4·868 B.Th.U. respectively per cubic foot of gas. Adding these to the simple combustibles of Table IV., we get 600·2, 532·76, and 67·45 as the gross, net, and difference. That is, the net calorific value required by the analysis is 532·76, as against the observed 541·94—a difference of 9.18 B.Th.U. Taking these figures, with the qualifications and limitations set forth, we may regard them as at least an alternative to the observed figures. Multiplying 67·45 by $6\frac{1}{7}$, we obtain as gross B.Th.U. per cubic foot (from the observed 600·25) that 414·33 are due to hydrogen and 185·92 to carbon. The last figure divided by 3·148 candles, the illuminating power of the gas containing CO_2, gives 59·06 B.Th.U. per candle; while if divided by 3·428, the computed illuminating power when the CO_2 is removed, we obtain 54·23 B.Th.U. per candle.

The disparity between the observed values for the net and difference figures and those computed from analysis, is rather larger here, in Table V. for test No. 2, than it was in test No. 1, Table IV. The reversal of the sign for the C_nH_m difference figure being from + 4·78 to − 4·61 = 9·39 B.Th.U. Taking the new difference figure, we obtain by multiplying 65·35 by $6\frac{1}{7}$, 401·43 B.Th.U. as due to hydrogen, leaving 186·50 as due to carbon; producing an illuminating power of 3·274 candles with the CO_2 in, and computed as 3·550 candles with CO_2 out, giving 56·96 and 52·5 B.Th.U. from carbon per candle respectively.

TABLE V.—*Average of Three Analyses by Dr. Colman for Test No. 2.*

[Marked (3), (4), and (6) on p. 636 of the "JOURNAL" for June 8, 1909.]

—	Gross.	Net.	Difference.
Methane	322·26	288·37	33·89
Hydrogen	164 67	137·82	26·85
Carbon monoxide	31·98	31·98	0·00
Simple combustibles	518·91	458·17	60·74
C_nH_m by difference	69·02	73·80	+ 4·78
Average of three sets of observations	587·93	531·97	55·96
C_nH_m per cubic foot calculated from the above "C_nH_m by difference"	2556	2733	+177
C_nH_m per cubic foot computed as an olefine ($C_{3\cdot215}$ H 6·430)	2556	2385·60	−170 40
Ditto for 2·7 per cent. by volume in gas	69·02	61·41	4·61
Total calorific value per cubic foot	587·93	522·58	65·35

Reference has already been made to an accentuated case of this abnormality in analysis (3), as compared with the observed calorific values. The data for this case and for analyses (4) and (6) of the same series are given side by side in Table VI. They show a decreasing degree of discrepancy—viz., 14·51, 10·13, 3·5 respectively. These figures show the difference between the observed values for the net, and those which the analyses requires. The greatest disparity is 68·98 per analysis as against 83·49 deduced from the observed values. In order to obtain, if possible, an approximate idea of the composition of the complex combustibles, the method of computation adopted in Table V. is continued here as well as in Table VII. The results thereof, when compared with the illuminating values, show a remarkable degree of consistency, and lead to the opinion that the illuminating and gross calorific values of the observations during the tests are essentially concordant. Table VII. bears out these conclusions, and yields

TABLE VI.—*Details of Test No. 2 of Table I.*

—	Marked (3) on p. 636.			Marked (4) on p. 636.			Marked (6) on p. 636.		
	Gross.	Net.	Difference.	Gross.	Net.	Difference.	Gross.	Net.	Difference.
Methane	326·59	292·25	34·34	314·49	281·42	33·07	325·58	291·34	34·24
Hydrogen	161·52	135·18	26·34	166·73	139·54	27·19	165·75	138·72	27·03
Carbon monoxide	31·98	31·98	0·00	32 30	32·30	0·00	31·65	31·65	0·00
Simple combustibles	520·09	459·41	60·68	513·52	453·26	60·26	522·99	461·72	61·27
C_nH_m by difference	73·91	83·49	+ 9·58	66·88	72·54	+ 5·66	66·41	65·48	− 0·93
Observed calorific values B.Th.U.	594·00	542·90	51·10	580·4	525·8	54·6	589·40	527·20	62·20
C_nH_m per cubic foot computed from the above "C_nH_m by difference"	2737	3092	+355	2388	2591	+203	2554	2519	− 35
C_nH_m per cubic foot calculated as an olefine	2737 $C_{3\cdot44}H_{6\cdot88}$	2554·68	−182·32	2388 C_2H_6	2229	−159	2554 $C_{3\cdot215}H_{6\cdot426}$	2384	170
Ditto for percentage by volume in gas	73·91	68·98	− 4 93	66·88	62·41	4·47	66·41	61·98	4·43
Total calorific value per cubic foot	594·00	528·39	65·61	580·40	515·67	64·73	589·40	523·70	65·70
Heating power per cubic foot due to hydrogen	403			397·6			403·6		
Heating power per cubic foot due to carbon	191			182·8			185·8		
B.Th.U. per candle for gas not freed from CO_2	= 3·372 × 54·6			= 3·212 × 56·91			= 3·238 × 57·38		
B.Th.U. per candle for gas freed from CO_2	= 3·666 × 52·1			= 3·464 × 52·70			= 3·518 × 52·80		

TABLE VII.—*Test No. 3, Average Analysis (Dr. Colman).*

[Thornley unscreened coal.]

—	Gross.	Net	Difference.
Methane	292·82	262·03	30·79
Hydrogen	177·77	148·78	28·99
Carbon monoxide	28·10	28·10	0·00
Simple combustibles	498·69	438·91	59·78
C_nH_m by difference	74·91	75·59	+ 0·68
Observed calorific values B.Th.U.	573 60	514·50	59·10
C_nH_m per cubic foot computed from the above "C_nH_m by difference"	2628·40	2652·30	+ 23·90
C_nH_m per cubic foot computed as an olefine C_3·3H6·6	2628·40	2453·10	175·30
Ditto for 2·85 per cent. by volume in gas	74·91	69·91	5·00
Total calorific power per cubic foot	573·60	508·82	64·78
Heating power per cubic foot due to hydrogen	398·0		
Heating power per cubic foot due to carbon	175·6		
B.Th.U. per candle for gas not freed from CO_2	= 3·112 × 56·42		
B.Th.U. per candle for gas freed from CO_2	= 3·252 × 53·99		

Table IX. is obtained, which shows close agreement between the two coals, in the heat due to carbon; while the difference in heat due to hydrogen is not large. The last column but one of Table IX. represents the useful effect of the gases in the matter of heat, and shows a difference of less than 4 per cent. between the coal substance of the Orrell washed nuts and that of the unscreened Thornley coal when distilled in the vertical retorts of Messrs. Glover and West. As to how these figures compare with a factor, 53·99, not far removed from the 52·5 of Table V., which latter, of course, represents the average of Table VI.

Considering that a different coal is here dealt with, and that only one analysis is presented, the similarity is quite close, though at the same time it is probable that if more extensive data were available, both sets of factors would come out a little lower.

CONCLUSIONS BASED ON ANALYTICAL DATA.

Adopting, then, provisionally, the calorific values deduced from the several analyses, we are able to compile Tables VIII. and IX. The gross values of Table I. are, of course, not affected; but the net values show a diminution, and the difference figures of lines 9 and 12 of Table I. show (in the fourth column of Table VIII.) a considerable alteration in the direction of greater consistency. Taking these difference figures, I have calculated the amount of heat in each gas due to the presence of hydrogen (net) and that due to carbon; and the results are given in the last two columns of Table VIII. Extending the same method to the basis of "per ton of coal substance,"

TABLE VIII.—*Summary of Calorific Value of Gas Produced, Based on the Analytical Data.*

Cubic Feet per Ton.	B.Th.U. per Cubic Foot of Gas.			B.Th.U. per Ton of Coal Distilled.			B.Th.U. per Ton of Coal Distilled.	
	Gross.	Net.	Difference.	Gross.	Net.	Difference.	Net Due to Hydrogen.	Net Due to Carbon.
11,779	600·25	532·80	67·45	7,070,344	6,275,851	794,493	4,085,964	2,189,887
11,448	587·93	522·58	65·35	6,730,623	5,982,496	748,127	3,847,510	2,134,986
13,102	573·60	508·82	64·78	7,515,307	6,666,559	848,748	4,364,990	2,301,569

TABLE IX.—*Heat Produced by Gas from One Ton of Coal Substance, Based upon the Chemical Analyses.*

In Vertical Retorts at St Helens.	Heat Due to Hydrogen.		Heat Due to Carbon, B.Th.U.	Heat Due to Carbon and Hydrogen.		
	B.Th.U. Gross.	B Th.U. Net		B.Th.U. Gross.	B.Th.U. Net.	Difference.
No. 1 test	Not available	..	Not available	..	..	..
,, 2 ,,	5,157,260	4,317,706	2,395,900	7.553,160	6,713,606	839,554
,, 3 ,,	5,449,138	4,562,069	2,405,489	7,854,627	6,967,558	887,069

the distillation of similar coal in horizontal retorts there are not sufficient data to hand; but inasmuch as the coal in these vertical retorts remains for about 12½ hours, it will be an instructive comparison to see how the results stand with those recently given by Mr. J. Ferguson Bell for twelve-hour charges in horizontal retorts at Derby.

In the St. Helens test, as already mentioned, there are two difference figures per cubic foot that are specially noteworthy for their smallness—viz., the 51·1 in analysis (3) of test No. 2, and 50·17 of test No. 4. Judging by the results of the detailed numerical examination of the several analyses, one is inclined to consider the question as one worthy of further investigation; as it frequently happens that useful information lies behind an unusual return. If the low difference figure means that the gas in the experiments was of an unusual order, then it is desirable to know the characteristics thereof, and learn at least the carbon and hydrogen densities of the unsaturated hydrocarbons.

The following particulars, though not seriously affecting the preceding considerations, have been compiled in order to bring the collateral questions into view. They show that in test No. 1, the coal of which contained the maximum of moisture, the greatest weight of bulk coal was distilled per hour. This test, too, is credited with the lowest fuel consumption and the highest return in sulphate of ammonia.

No. of test.	1.	2.	3.
Date of test (1909)	March 10 to 13.	May 20 to 24.	July.
No. of hours trial	72	96	72 (?)
Weight of coal distilled per hour, in tons	0·1059	0·09727	0·10373
Weight of coal distilled per hour, in pounds	237	218	232
Cubic feet of gas made per retort, per hour	1247	1113	1359
Coke used as fuel per 100 lbs. of coal distilled, lbs.	12·02	12·06 (dry)	12·3 (dry)
Ammonia per ton of coal equivalent to sulphate, lbs.	34 33	33·40	26·7

CALORIFIC POWER STANDARD OF THE GASLIGHT AND COKE COMPANY.

The Clauses of the Act.

A PRINT of the Act of the Gaslight and Coke Company is now before us; and, in due course, the chief features of its provisions will be noticed. Meantime, we reproduce the calorific power clauses, which naturally will have most general interest.

39. (1) As from the 1st day of January, 1910, the standard calorific power of the gas supplied by the Gaslight Company within the Gaslight district and the West Ham district shall be 125 calories net per cubic foot (the expression "calories" being used in this Act as meaning calories net per cubic foot); but the Gaslight Company shall not incur any liability in the event of their supplying gas of a calorific power of not less than 112½ calories.

(2) One testing only for calorific power shall be made at each testing-place daily; but in the event of the calorific power being on any testing ascertained to be below 112½ calories, the Gas Examiner shall forthwith give notice thereof to the Gaslight Company; and a second testing shall be made at an interval of not less than one hour from the time of making the first testing at that testing-place, and the average of the two testings shall be deemed to be the calorific power of the gas at such testing-place on that day.

40. The following provisions shall apply with respect to the testing for calorific power of the gas supplied by the Gaslight Company within the Administrative County of London, and to forfeitures in respect of deficient calorific power of such gas.

(1) If on any one day the gas supplied by the Gaslight Company at any testing-place is of less calorific power to an extent not exceeding 6 calories than 112½ calories, the average of the testings for calorific power made at such testing-place on that day and on the preceding day and on the following day shall be deemed to represent the calorific power of the gas on such one day at such testing-place.

(2) The Gaslight Company shall not be liable to any forfeiture for defective calorific power where the calorific power on any day of the gas supplied by them is not less than 112½ calories; but where the calorific power on any day of such gas is less than such last-mentioned quantity, the Gaslight Company shall be liable to the following forfeitures in respect of such deficiency (that is to say)

Where the deficiency does not exceed 3 calories, £5;

Where the deficiency exceeds 3 calories, but does not amount to 6 calories, a sum not exceeding £10;

For each complete 6 calories of defective power, a sum not less than £25, and not exceeding £100.

Provided always that the controlling authority of any testing-place having recovered one forfeiture in respect of defective calorific power in the gas supplied by the Gaslight Company at one testing-place on any day shall not be entitled to any further forfeiture in respect of defective calorific power in the gas supplied by the Gaslight Company at any other testing-place of such controlling authority on the same day. Provided also that no forfeiture shall be incurred in any case with respect to which it is certified by the Chief Gas Examiner that the defect of calorific power was occasioned by an unavoidable cause or accident.

(3) Section 10 (Company may be Represented at Testings) of the Act of 1880 shall with respect to the Gaslight Company be read, and have effect, as if calorific power were therein referred to in addition to illuminating power, purity, and pressure.

(4) Section 11 (Daily Reports and Access to Books) of the Act of 1880 shall in relation to the Gaslight Company extend and apply with respect to the testings for the purposes of this section.

(5) Section 13 (Quarterly Report of Chief Gas Examiner) of the Act of 1880 shall in relation to the Gaslight Company be read and have effect as if there were added at the end thereof: "(4) The calorific power on each day at each testing-place of the controlling authority."

(6) The provisions of Section 19 (Forfeitures and Losses from Fraud, &c.) and Section 20 (Recovery of Forfeitures, &c., 23 and 24 Vict. c. 125) of the Act of 1880 shall extend and apply to forfeitures under this section, and to the recovery thereof.

(7) The following provisions of the Act of 1905 shall extend, and apply to, and for the purposes of, the testing for calorific power of the gas supplied by the Gaslight Company within the Administrative County of London (that is to say)

Sub-Sections (1) and (4) of Section 5 (As to testing for calorific power, sulphur impurities, and illuminating power with flat-flame burner) so far as such sub-sections relate to testings for calorific power; Section 9 (Appeal by Company to Chief Gas Examiner against prescription or certification of Gas Referees); Section 10 (Sunday testing); Section 11 (Amendment of Section 12 of Act of 1880); Section 12 (Further powers to Chief Gas Examiner as to forfeitures); Section 13 (As to hearing in absence of parties); Section 15 (Penalty for neglect to comply with prescriptions of Gas Referees); Section 16 (Proceedings in case of forfeiture); Section 17 (Proof of report, &c., of Chief Gas Examiner); Section 18 (As to service of notices).

But Sub-Sections (2) (3) and (5) of the said Section 5 shall not apply for the said purposes.

(8) Section 14 (Amendment of Section 18 of Act of 1880) of the Act of 1905 shall extend, and apply to, and for the purposes of, this section as if the words "defective calorific power" had been inserted therein after the words "defective illuminating power."

41. The following provisions shall apply with respect to the testing for calorific power of the gas supplied by the Gaslight Company within the West Ham district, and to forfeitures in respect of deficient calorific power of such gas.

(1) The Gaslight Company shall within six months from the date of transfer or from the date of the provision of the testing-place (whichever shall be the later) cause to be provided at each of the prescribed testing-places within the West Ham district apparatus for testing the calorific power of the gas supplied by the Gaslight Company at such testing-place; and the said apparatus and the mode of making the tests shall be the same as shall from time to time be prescribed by the Gas Referees appointed under the City of London Gas Act, 1868, for testing the gas supplied by the Gaslight Company within the Metropolis.

(2) The Gas Examiner of the controlling authority may, at any testing-place of that authority, test, at any hour of the day or night, the calorific power of the gas supplied by the Gaslight Company at such testing-place.

(3) If on any one day the gas supplied by the Gaslight Company, at any such testing-place, is of less calorific power to an extent not exceeding 6 calories than 112½ calories, the Gas Examiner of the controlling authority shall (if the controlling authority contemplate proceeding for a forfeiture) make at such testing-place a testing of the calorific power of such gas on each of the two following days, and the average of the three testings so made shall be deemed to represent the calorific power of the gas on such one day at such testing-place.

(4) The Gaslight Company shall not be liable to any forfeiture for defective calorific power where the calorific power on any day of the gas supplied by them at any such testing-place is not less than 112½ calories; but where the calorific power on any day of such gas is less than such last-mentioned quantity, the Gaslight Company shall be liable to the following forfeitures in respect of such deficiency (that is to say)

Where the deficiency does not exceed 3 calories, £5;
Where the deficiency exceeds 3 calories but does not amount to 6 calories, a sum not exceeding £10;
For each complete 6 calories of defective power, a sum not exceeding £20.

(5) The provisions of Section 31 of the Gas-Works Clauses Act, 1871, shall apply to any testing made under this section.

(6) For the purposes of this section, Section 33 of the Gas-Works Clauses Act, 1871, shall be construed as if calorific power were therein referred to in addition to illuminating power and purity.

42. If within one month after the expiration of a period of three years from the 1st day of January, 1910, or after the expiration of any subsequent period of three years, either the Gaslight Company or the London County Council or the Mayor, Aldermen, and Commons of the City of London in Common Council assembled, shall desire that the standard calorific power prescribed by the section of this Act of which the marginal note is "Calorific Power of Gas Supplied" shall be reduced or increased, and shall give to the other parties and to the Board of Trade notice in writing of such desire, it shall be lawful for the Board of Trade, after hearing the parties, and considering any representations made to them by any of the said parties, by order to reduce or increase the amount of the said standard calorific power, and of the deficiency below such standard within which the Gaslight Company are not to be liable to forfeitures, or either of such amounts, to such extent as to the said Board may seem fit; and the said Board may, by such order, make all such modifications of this Act as may be necessary in consequence of any such reduction or increase as aforesaid, and may also direct the manner in which the costs, charges, and expenses of the said parties and of the said Board of, and incidental to, any such application and any inquiry held by, or under, the direction of the said Board in connection therewith, shall be borne.

THE AMMAN VALLEY PROMOTION.

Where the Subscribed Capital has Gone.

THE past parliamentary session threw a fierce light upon the tactics of the company promoters whose operations are conducted from No. 99, Cannon Street. The *denouement* was witnessed of the plot that had for its primary object the enriching of the promoters of the Amman Valley Gas Company, to the wretched history of which we have been duty-bound to somewhat frequently draw attention. With the impudence characteristic of many of the prospectuses issued from No. 99, Cannon Street, the promoters of the Amman Valley Bill mentioned, in the preamble, that to the vendors of this rotten concern (which in time had small works, but could not supply gas, as the local authority declined to allow them to open the roads)—the vendors being one of Eaton's pieces of machinery, the Gas and Water Works Supplies and Construction Company, Limited—there had been issued, in part payment for the consideration set forth in the agreement and for other consideration, 5255 fully paid-up ordinary and preference shares and £2770 of debenture stock, to other contractors £2390 of debenture stock, and to certain creditors, as collateral security for money owing, £2720 of debenture stock. In the Bill it was asked that this £5255 of ordinary and preference shares and £7880 of debenture stock should be cancelled. The Ammanford Bill was also promoted, in order to wipe the Amman Valley Company out of existence—shareholders of the latter recognizing that, under the Eaton administration, there would be nothing but loss and trouble for them, and that the Company, through the tactics of the promoting element in the concern, would not do any good, having fallen foul of the local authority and the public generally in the district. Meantime creditors were knocking at the doors of the Amman Valley Company. In the preamble of the Ammanford Bill, it was stated that the vendors were also the contractors for the works—the Gas and Water Works Supplies and Construction Company, Limited; and this is interesting, in view of certain payments mentioned in the figures published below. The history of the year records how a Receiver was appointed in connection with the Amman Valley concern, how the promoters of the undertaking were driven into such a tight corner that the only way out of it was by withdrawing their Bill, and agreeing to sell the works at arbitration price, which will not by "a long chalk" represent the money that passed through the hands of the promoters. The amount awarded will be paid to the Amman Valley people; and they will have to satisfy their creditors, so far as they can, out of the remnant of cash that will be all there is to set opposite the subscribed capital.

One of the greatest regrets of the parliamentary session was that, through the course of events, there was no chance of getting Eaton and some of his associates into the witness chair, and eliciting from them something as to the value of the work they do in connection with these promotions, and their views as to the values of the work executed through that concern with a past—a somewhat extraordinary and unenviable past—the Gas and Water Works Supplies and Construction Company, Limited. In connection with the Ammanford Bill, Mr. E. H. Stevenson was prepared with evidence as to the value of the Amman Valley concern in relation to the payments that had flowed through the books of No. 99, Cannon Street. In his evidence before the Unopposed Bills Committee in May last, Mr. Stevenson stated that much of the money subscribed had gone, by one road or another, into the pockets of the promoters; and he gave it as his well-considered opinion that he did not believe the shareholders would ever get back a penny of their money. He had good reason for saying this, as he had in his possession the following statement as to the financial position of the Amman Valley Company at the beginning of December, 1908. In connection with the notice of the Ammanford Act in another column, it is a convenient time to publish it; and this we do with Mr. Stevenson's consent.

Statement of the Amman Valley Gaslight and Coke Company, Limited.

SHARE AND DEBENTURE CAPITAL.

Authorized share capital		£25,000
Issued to the public—		
Preference	£4,405	
Ordinary	5,592	
Vendors*—		
Preference	2,550	
Ordinary	3,505	
Total share capital issued	£16,052	

*The Vendors paid £500 cash for £500 worth, pound for pound.

Authorized debenture capital—		£12,500
Issued to the public	£3,980	
Vendors*	2,770	
Other contractors	4,410	
Other creditors as security only	1,000	
Total issue of debenture capital	£12,160	

* £2690 of this is held by the Vendors as security only for moneys advanced or owing.

RECEIPTS.

Public subscriptions—	
Shares	£9,997
Debentures	3,980
Subscribed by Vendors for shares	500
Lent Company by Vendors	950
	£15,427

PAYMENTS.

Contractors	£7,450
Buildings account	1,000
Mains purchased and laid	915
Mains purchased but not laid	570
Issue expenses	3,410
Directors' fees	170
Engineers' fees	150
Salaries	50
Debenture interest	430
Meters and stoves	300
Wages	200
Coal and coke	25
Cash proceedings to date	100
Law costs	125
Opening ceremony	25
Tools, &c., bought	100
Loans repaid	75
	£15,095

Balance must be accepted as spent on stationery, petty cash, and general office expenses.—(Signed) P. DAVIES, *Secretary*.

The tremendous sum spent on these small works, through Eaton's Construction Company, will be noted, as will also be the issue expenses for such a capital. A study of the accounts will show that Mr. Stevenson cannot be far wrong in his ominous prediction that the shareholders stand a poor chance of getting back a penny of their money.

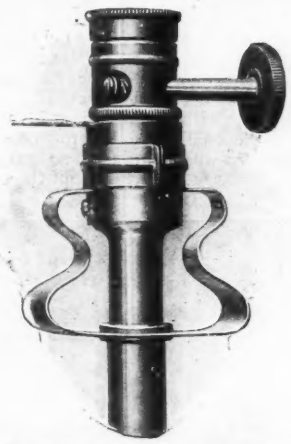
Eastern Counties Gas Managers' Association.—As was briefly intimated in last Tuesday's issue, the 42nd general meeting of the Association will be held at Hull on Thursday of this week. The members and friends will assemble at the Royal Station Hotel, where they will be entertained at luncheon by the Chairman and Directors of the British Gaslight Company. After the subsequent business meeting, there will be a dinner at the hotel. On the following day there will be an inspection of the British Gaslight Company's works and those of the East Hull Gas Company. On returning to the Royal Station Hotel, the party will be the guests at luncheon of the Chairman and Directors of the East Hull Gas Company. The *agenda* for the meeting, in addition to some formal business, includes the Inaugural Address of the President (Mr. John Young); the discussion of Mr. W. J. Carpenter's paper on "Gas Practice at Great Yarmouth," which was postponed from the last meeting; and a paper by Mr. John Holliday, entitled "Gasholder Reconstruction (a Few Notes)," which will be accompanied by a series of lantern slides showing the progress of the work from start to finish.

"AIROSTAT" INVERTED GAS-BURNER.

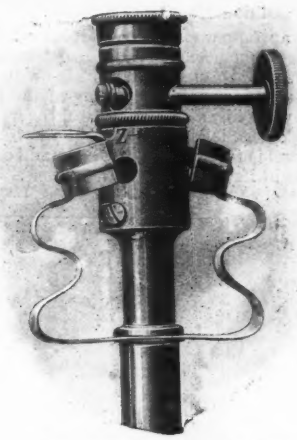
We have long since given up all idea that the ingenuity of man has reached finality in the matter of developing the efficiency of the inverted incandescent gas-burner. The comparatively small quantity of gas that is used for a given illumination, and the adjustment that is necessitated for securing the proper proportioning of the gas and air supplies, and the complete combustion of the mixture (thus realizing the highest flame intensity), has brought into use means whereby delicate regulation of the gas and air supplies is effected by hand; and inventors are constantly at work trying in the same channel to achieve greater things.

At the offices of Messrs. Julius Norden, Limited, of No. 44, Farringdon Street, E.C., a further development of the methods of regulation is shown in the new "Airostat" burner ("Degea"). The name of the burner is derived from its chief feature—that is to say, the means employed for automatically regulating the primary air supply to the burner; the automaticity being obtained by the operative action of the heat of the burner itself.

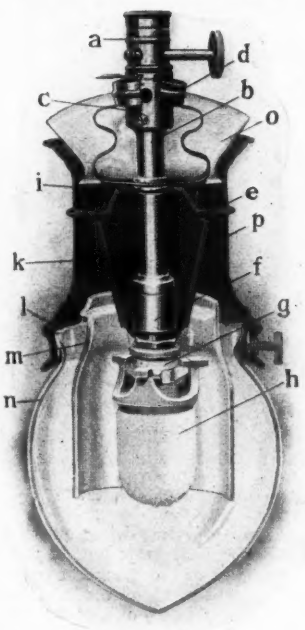
The illustrations of the bunsen tube show a pair of double-curved arms, carrying at the top clips, which, in the one case, are shown covering, although not completely closing, the air-inlets; in the other case, the clips are open, giving free entrance to the air supply. This fitting is composed of a special alloy, which in the matter of expansion and contraction is very sensitive to changes of temperature. The fitting is so made that, when the burner is not in use, and therefore cold, the clips almost close the air-holes; and, when the burner is lighted, the clips recede from the holes as the temperature increases. The main idea underlying this arrangement is that, when the burner is first lighted, and the burner and therefore the gas are comparatively cold, very little air is required for complete combustion; but, as the temperature increases, an enlarged quantity of air is required until the maximum is reached. That is the ground submitted for the chief utility of this additional device. As a matter of fact, we all know that often, when inverted burners are first of all lighted and cold, there is some little noise. But as the burner heats up, this disappears; and it is not until the burner is heated up that the proper time arrives for making the final adjustment of the air supply. Another consideration advanced is that, when an inverted burner is first lighted, if the air supply is too copious, there is danger of lighting-back; and then later, when the burner is heated up, if there is not sufficient air to ensure complete combustion, the flame smokes, there is an unpleasant smell, and the illuminating power is not what it should be. In the case of the new burner, however, the air supply is adjusted by the temperature through the little device described and illustrated. When the burner is first lighted, very little air is admitted through the holes being almost closed; but the air supply is an increasing quantity as the temperature of the burner rises, and the clips recede from the air-inlets. When the proper quantity of air is passing, as judged by the maximum illuminating power of the mantle being attained, the sliding air-collar round the air-holes (a collar provided with an arm, so that it can be readily moved when the burner is hot) can be set to that point; and then, until the burner requires cleaning, the primary air regulation will proceed automatically, no matter the temperature. During some trials witnessed with the burner, there was no noise on lighting up; and the opening and closing of the primary air-holes proceeded regularly as the burner became heated up, or as the flame was reduced, or was finally extinguished. This is another point, that the gas-flame can be turned quite low, and yet the air supply will be automatically adjusted, without interfering with the secondary regulator that is set for the gas-supply when full on with the burner fully heated up. It will also be apparent that, the clips closing the air-holes when the burner is cold, the interior of the burner is protected from dust during the whole of the many non-lighting hours. This should be of considerable advantage in mills and factories where there is a great deal of floating dust or flux through the working hours.



The "Airostat" Regulator Closed.



The "Airostat" Regulator Open.



A Section of the "Airostat" Inverted Gas-Burner.

Among the other features of the burner is a solid needle gas-regulator, which can be used to tightly close off the gas, or by it the finest adjustment can be effected. But it is impossible to overturn the regulator, as the operating shaft is provided with a strong screw-thread and stop, beyond which one is not able to turn it, so that there is no possibility of gas escaping. The needle-regulator is provided with an independent, detachable chamber, in the top of which a dust-trap is formed. The designers of this burner are also of opinion that the varying temperatures to which the mixture of gas is exposed in some types of inverted burner do not contribute to the uniformity of its illuminating power; and therefore further protection is given by surrounding the bunsen tube with a separate metallic casing, so that the temperature of the ascending products of combustion shall not disturb the mixture. The nozzle of the bunsen, which supports the mantle, is made of a special ceramic composition, and is very strong; so that there can be no deformation—the nozzle being thus kept absolutely straight with the mantle. A further feature is that the burner is fitted with an interior glass, which is supported by a simple form of bayonet joint; but, in the smallest size of the burner, this interior glass can be dispensed with, if desired. As to the outer glasses, these can, of course, be of any style, or of any degree of decoration, according to the purpose to which the burner is going to be applied. At the top of the burner, a pair of diverting wings form bilateral outlets for the escaping products of combustion, and, at the same time, prevent deterioration of the primary air supply by the latter.

The combination of the parts of the lamp will perhaps be better understood by reference to the lettered illustration of the complete lamp. In this, *a* represents the gas-regulator; *b*, the bunsen tube; *c*, the air-regulating collar; *d*, the "airostat;" *e*, the mixing-tube; *f*, enlarged extension of the bunsen; *g*, burner mouthpiece; *h*, the nozzle; *i*, bridge supporting diverters for the products of combustion; *k*, the outside casing; *l*, the inner glass holder; *m*, the inner glass; *n*, the globe; *o*, the diverter for products of combustion; and *p*, the protector for the bunsen tube.

The "Airostat" burner is made in three sizes. According to information before us, the ordinary size gives about 100-candle power for a consumption of about 3⅜ cubic feet of gas; the medium size gives about 55-candle power for about 1¾ cubic feet of gas; and the dwarf burner gives about 32-candle power for 1 cubic foot of gas. These figures represent high efficiencies; but Mr. Norden particularly requests us to say the figures are approximate, and will, of course, vary according to the quality and pressure of the gas. The dwarf burner is undoubtedly economical; and the firm are putting it forward as a competitor even with the best electric lamp for domestic purposes.

These are the main features of the "Airostat" burner, which is strongly made, and, in its design, the purposes kept in view are a high efficiency, and the maintenance of that efficiency with as little trouble as possible.

A NEW COKE-DISCHARGING MACHINE.

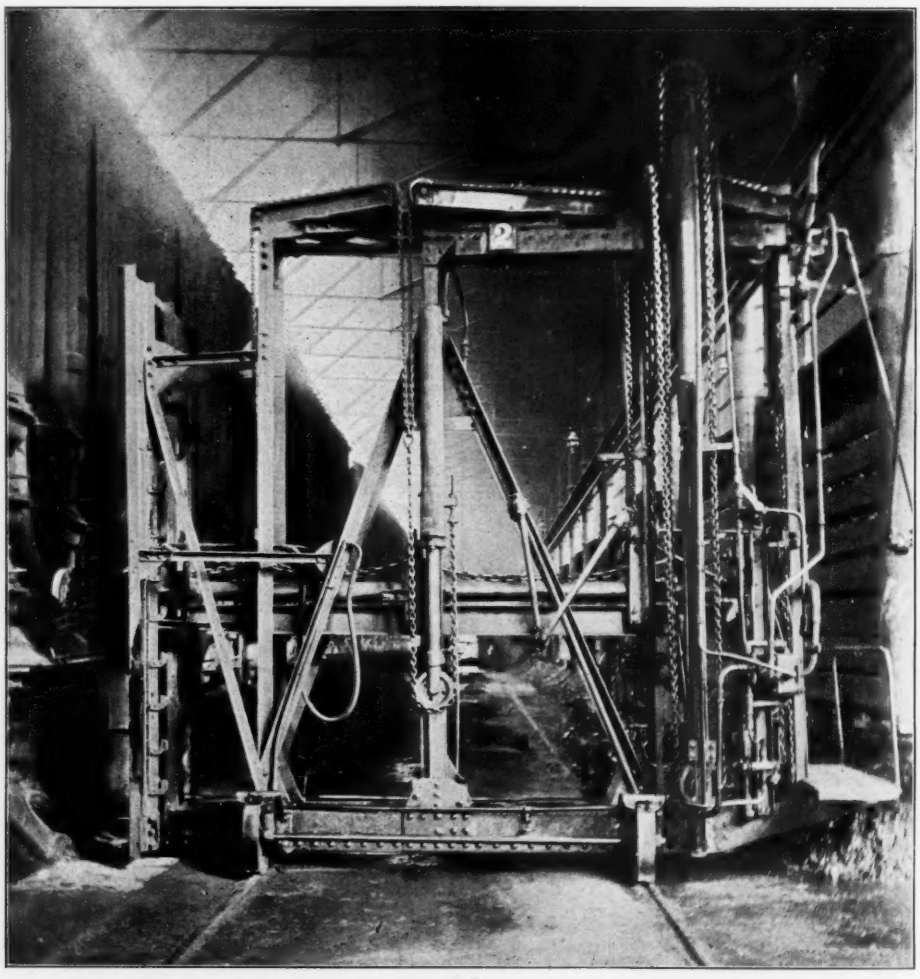
Williams' and M'Phee's Patent.

[COMMUNICATED.]

THE hydraulic coke-discharging machines designed and patented by Messrs. P. E. Williams and N. M'Phee, and installed last year at the Commercial Gas Company's Poplar Works, have given unqualified satisfaction. The machines are simple in construction, powerful, and extremely reliable in their action (the wear and tear at the same time being very small); and a short description of them will doubtless be of interest.

In the accompanying photograph, it will be seen that the machine comprises a pusher, constituted of telescopic rams and cylinder secured to a beam suspended within the framework of the machine, and raised or lowered by means of the lifting ram and cylinder secured vertically to the outside of the frame. The cylinder, with drawback ram, is also attached to the framework. On the small pusher-ram is fitted a pusher-plate; and each ram is provided with a stopper at its rear end.

A special controlling valve with one exhaust and two pressure ports is provided for admitting fluid pressure to, and exhausting from, the cylinder of the pusher and that of the withdrawing ram. After the completion of the outward stroke for the purpose of discharging the coke, the pusher-rams are brought back into their original positions in the cylinder by means of a chain attached to the pusher-plate and carried over pulleys to the withdrawing ram and cylinder. On the outward stroke of the pusher-rams, the chain attached to the pusher-plate pulls in the withdrawing ram. On admitting pressure to the withdrawing cylinder, the withdrawing ram by its outward stroke pulls in the pusher-rams by the chain. Pressure for this purpose is admitted to the withdrawing cylinder automatically; and at a predetermined point of the outward stroke of the pusher, the withdrawing ram-head engaging a tappet-rod connected by a lever to the distributing valve of a small actuating ram, the stroke of which, by suitable means, reverses the controlling valve, opens the exhaust-port to the pusher cylinder and the pressure port to the withdrawing cylinder, and thus withdraws the pusher-rams. The position of the tappet on the rod connected to the lever of the distributing valve is adjusted so that the pusher completely clears the coke from the retort; but the reversal of the rams is easily effected by the man



The Williams-M'Phee Patent Hydraulic Coke Discharger Operating in the Poplar Gas-Works.

in charge, who simply raises the rod connected with the lever of the distributing valve. The chain connecting the pusher-plate to the withdrawing ram is so arranged that it automatically adjusts itself to the varying heights of the beam which carries the pusher cylinder and rams. In practical working, the outward and backward strokes are made in ten and eight seconds respectively. The machine traverses the stage by means of a three-cylinder hydraulic motor.

As an outcome of the introduction of these pushers, it has become possible to carbonize heavier charges and to increase the duration of the charge from six hours to eight hours with a nearly proportionate reduction in wages. The writer's experience has gone to prove that, with one exception, the advantages are all in favour of the use of pushers. The retorts may be practically filled with coal; and for convenience in working, an eight-hour charge has distinct advantages. The coal carbonized per retort per hour may be increased by from 8 to 10 per cent.; and the yield of gas of a practically identical illuminating power is increased from 150 to 200 cubic feet per ton. The increase in the make of gas per retort is undoubtedly due to the fact that a greater area of the heated surface of the retort is in contact with the coal. The gas is more rapidly driven out, and is consequently not subjected to the high heat for so long a period; and further proof is found in the fact of the greater freedom from stopped pipes. There is a marked improvement in the quality of the coke. The quenching of about 7 cwt. of red hot coke, which is removed from the retort in ten seconds, presents some difficulty, but can be overcome by an abundant supply of water showered over the coke for a short time. The tar is certainly less viscid, and contains 2 or 3 per cent. less water. The writer has not yet made a complete analysis of the tar; but the presence of only 3 to 4 per cent. of water is a distinct gain to the tar distiller. There is also a noticeable increase in the quantity of sulphate of ammonia produced per ton of coal.

In regard to carbonizing wages, this item of expenditure has been reduced nearly 25 per cent.; and in addition to this, there is less wear and tear of stoking machinery and retorts. It has also been found expedient to pay all the workmen on the stage the same rate, and to train them to perform all the necessary duties. This system works admirably. Messrs. W. C. Holmes & Co., of London and Huddersfield, have undertaken the construction of the machines.

THE

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CURTIS'S & HARVEY, Ltd.,

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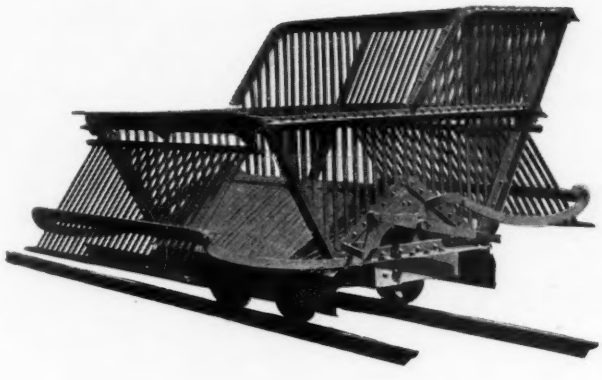


BELTON'S PATENT HOT COKE SKIP.

Large Capacity.

Most of the bars are free to expand or contract without distorting truck. Large delivery doors on each side, each operated separately from either end of truck. Our single-pull door operating gear is unaffected by heat. One pull is sufficient to unlock, open and lock in open position, or *vice versa*.

No catches or springs to get out of order. The body can be arranged as a truck or can be applied as a skip for cranes, electric telphers and wire rope hoists, &c.

Specially suitable for working in conjunction with Pusher Discharging Machines and Vertical Retorts.

LESS BREEZE WHEN QUENCHED IN BULK.

SOLE MAKERS:

ROBERT DEMPSTER & SONS, LD.,

ELLAND.

SUGG'S

PATENT

INVERTED INCANDESCENT GAS BURNERS,

No. 1 size consume 1¼ ft. per hour.

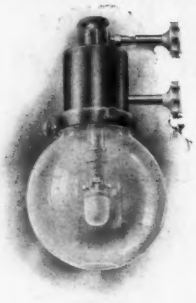


Fig. 1960.

No. 2 size consume 2 ft. per hour.

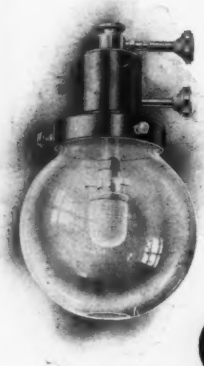


Fig. 1970.

For SHOP LIGHTING, &c.

THESE BURNERS

GIVE A LIGHT EQUAL TO

45

CANDLES

No. 1 size consume 1¼ ft. per hour.

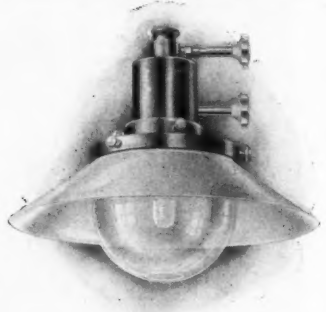


Fig. 1961, with opal shade.

No. 2 size consume 2 ft. per hour.

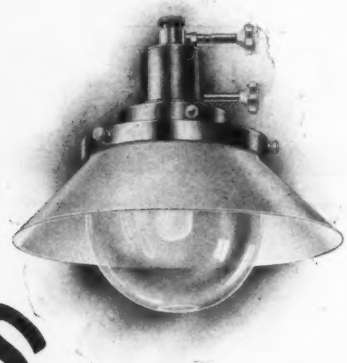


Fig. 1971, with opal shade.

FOR EACH CUBIC FOOT OF GAS CONSUMED

No. 4 size consume 3¾ ft. per hour.

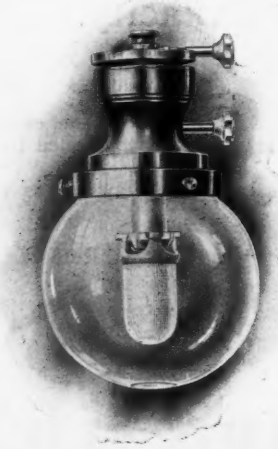


Fig. 1980.

ORDINARY PRESSURE OF GAS.

THE OPAL SHADE

is carried by a separate holder and does not rest on the globe.

Please write for full particulars and price lists.

No. 4 size consume 3¾ ft. per hour.

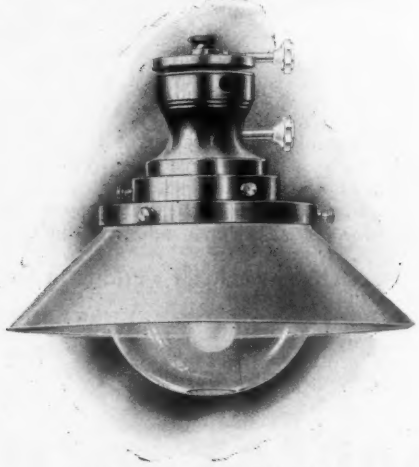


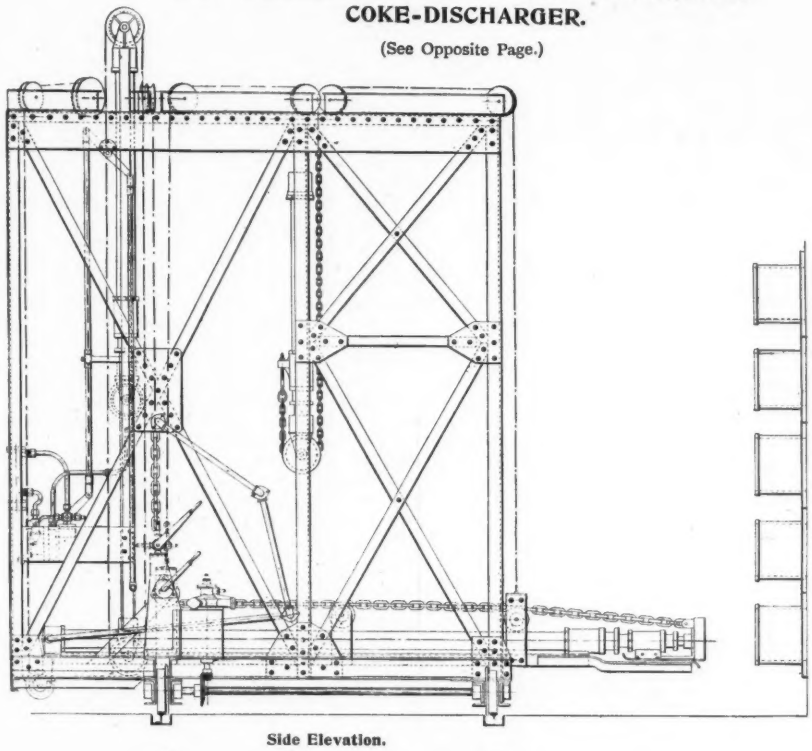
Fig. 1981, with opal shade.

WILLIAM SUGG & Co., LIMITED. ENGINEERS, WESTMINSTER.

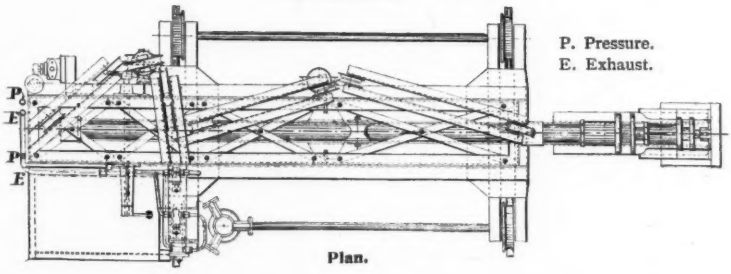
Telegrams: "SUGG, LONDON." Telephone: 5153 (2 lines) WESTMINSTER.

THE WILLIAMS-M'PHEE PATENT HYDRAULIC COKE-DISCHARGER.

(See Opposite Page.)



Side Elevation.



P. Pressure.
E. Exhaust.

Plan.

THE PARKINSON STOVE COMPANY'S NEW GOODS.

We cannot review the wide and various models in gas-fires and heaters for the coming season without calling attention to the new goods introduced by the Parkinson Stove Company, Limited, of Birmingham and London. We have had occasion previously to refer to the improvements introduced by this firm in gas-fire fuel—among other matters when their "Intense" pillar fuel was introduced; and there is no doubt they are giving a great amount of attention to this important subject. The "Intense" fuel has achieved considerable success; but an improved pattern is now being placed on the market, and owing to its special shape and general character a state of intense incandescence is quickly reached. A new pattern fuel-guard, as shown on the "Agate" fire, is supplied in conjunction with this fuel. With this, it will be noticed that there is nothing to prevent perfect radiation. Remarkable results have therefore been obtained in heating value, with the minimum gas consumption. Improvements of this type should go far to popularize the gas-fire for general use year by year; the Company's devices tending towards the reduction of gas consumption, while by means of improved fuel, &c., the efficiency of the fire is wonderfully increased. The fuel and the oval fire-front here referred to can be supplied with all single-row fuel fires when desired. The firm's gas and air adjuster has been improved for the season.

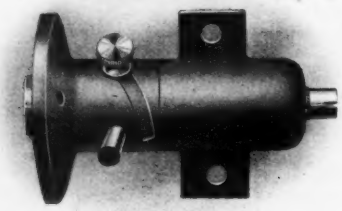
The "Intense" Pillar Fuel.

There is certainly a demand for stoves with larger fire-opening in the single-row fuel series. To meet this, the "Onyx" was introduced last year, with a 13-inch fire-front; and this is being followed now by the "Agate" fire, with a 15-inch opening. The "Intense" pillar fuel and oval guard are fitted to this design; and it is therefore a very powerful heater, and a pattern which

The "Agate" Fire.

for simplicity of design should harmonize with practically all surroundings. Modern improvements in regard to brick arrangements, &c., are included; and a duplex burner—an important adjunct—is also fitted when required. For such a stove a good market should be found; it being admirably suited for letting out on hire, and produced in good style, in various finishes.

In the "Savoy," a new art stove has been introduced which has

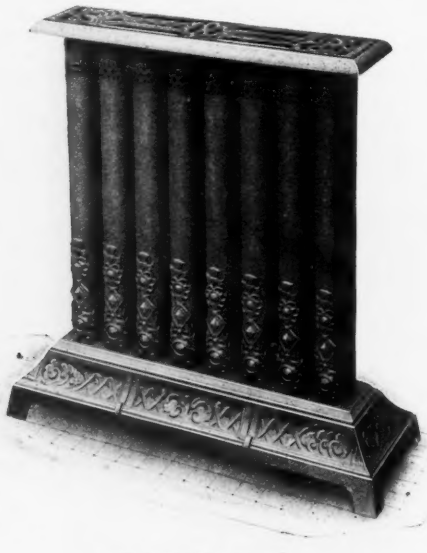


Improved Gas and Air Adjuster.

distinctive features and is a new departure in gas-heaters. It is produced in high-class style throughout in copper, and fitted with coloured glass panels, which give a very cheerful and pleasing

The "Savoy" Fire.

effect. For the heating of shops, cafés, restaurants, halls, &c., it should supply a long-felt want, in that it will harmonize with the general decorations.



The "Thistle" Radiator.

Other new patterns are introduced, including the "Thistle," a radiator on popular lines, made in various styles and finishes; and also a cast-iron ornamental back, which is very neat in appearance, and suitable for most of the firm's fires. In regard to gas-heated steam-radiators, it may be pointed out that, when required for certain positions—such as workrooms, &c.—these appliances can be fitted with a flue outlet—as originally made by the Company.

Midland Association of Gas Managers.—We are informed by the Hon. Secretary (Mr. Harold E. Copp) that the autumn meeting of the Association has been fixed for Thursday, Oct. 21, when it will be held under the presidency of Mr. W. Langford, of Longton, at the Grand Hotel, Birmingham.

RICHMOND'S GAS-FIRE IMPROVEMENTS.

No matter in what direction one looks in respect to the appliances by which gas is utilized, there are two essentials that govern from any stage further improvement, and they are experience and commercial success. The two combined stimulate to additional effort. There is the illustration of this in gas-fire production by the various makers. Looking round the show-rooms of the Richmond Gas Stove and Meter Company, improvement is seen on all hands. The old types have given place to the new, and more economical, efficient, and sightly ones. But we are principally concerned with what is seen in the "A. B. C." series of fires, which were originally introduced by the firm in 1907. The letters are the initials of the names given to the three fires—viz., "Arabian," "Bavarian," and "Castilian," which, from their introduction, have been, we learn, an unqualified success, whether for hire, hire purchase, or sale direct. One of the major commending features of this series was, and is, the interchangeability of parts, and therefore the relative smallness of the stock of parts required for maintenance purposes—that is to say, the parts of "A." are likewise applicable to "B." and "C.," and *vice versâ*. This is a feature the firm would not now on any consideration abandon. But there has been additional improvement; and the range has been extended by two further designs for larger and more important houses. The result is that the firm are in a position at the present time to offer five different designs, and fourteen different sizes, and yet only two sets of parts are needed for renewal. The hiring question is, by such provision, greatly and economically simplified.

In the main, the principal parts of the "A.B.C." series continue as heretofore. The first thing that is fresh that meets the eye is the front guard, which is more open than before, and is, as seen in the illustration, very tasteful in design. The question of the radiating power of gas-fires has been much to the fore of late; and it has been said that a certain amount of radiant heat is lost by the old close formation of the fuel guard. It is a debateable point

The "A.B.C." Series of Fire.
[Illustrating the New Guard and Fuel Arrangement.]

whether the loss is really anything very appreciable; but the fact remains that there is a fancy for seeing as much of the incandescent fire as possible, without running the risk of heated fuel falling from its position if it should become fractured or in any other way displaced. Of course, the new elongated form of fuel lends itself to the application of a more open grate; and to the extent thought desirable from the point of view of safety, the Richmond Company have made the departure illustrated.

A further improvement in this series of fires is in the fuel itself and in its arrangement; and herein is seen a material acknowledgment of the suggestions emanating from the Leeds University experiments being of advantage. Last year the firm introduced a loose brick slip between the range of fuel and the main back fire-brick. By the false back, protection was given to the latter; and an increase of radiating power was also found to result from bringing the lower portion of the fire-brick backing as near as practicable to the front. In this regard, therefore, there was clearly anticipation of the fruit of independent scientific investigation. But it was also suggested that there would be further advantage by making the fuel thicker at the back and rather thinner and of more open formation at the front. This idea has been adopted; and it is found to be an aid to heat radiation from the back of the fire. Furthermore, the length of the fuel has been extended. The first step was from ball fuel to cylindrical fuel in comparatively short lengths, set upright in a row, and along the top of which were laid horizontally other pieces of the fuel. The combined height of fuel thus formed is the length

now of the single cylinders of fuel; and a row of this fuel with the loose fire-brick back constitutes all the packing of the fires with one exception, which really gives a finish to the fuel, offers an obstruction to cold currents of air playing on to the radiating portion of the brickwork and the fuel, and in a measure acts as a deflector and heat retainer. The exception is constituted of two solid pieces of fire-brick, forming a crest to the loose fire-brick back and the fuel. The illustration will show the finish that these give to the fire surface. The old idea was to shape the fire-brick back with a projecting part overlapping the fuel. With the shallow fire, the fashion in this regard was not feasible, owing to the check it gave to the escape of the products of combustion. The alteration assists in rendering a greater proportion of the heat useful; for it is quite apparent that any conservation of top heat must usefully assist the bottom heat. The experiments made by the firm show that the change is efficacious in the better heating results secured; and yet there is, through the formation of the upright fuel, no check to the escape to the flue of the products of combustion.

The "D" Fire, showing the Large Heat-Retaining Canopy.

These fires are made with 10 and 13 inch wide fire fronts. But, by the changes effected, the heating surface is increased by about 1 inch in height; and therefore, the front heating surface is, according to the width dimensions of fire, increased in area by 10 or 13 square inches, as the case may be. The importance of this is evident, in view of the fact that the consumption of gas is not increased. There is one other point about the fuel. The face of the false fire-brick back is so curved that each length of fuel stands in its own curve; and so cannot shift from its perpendicular position over its own burner. The burners, by the way, have rectangular nozzles; and so give a flat flame. The fuel is supported well above the flames; and there is an unimpeded flame direct up each piece of cylindrical fuel. One of the fires seen alight was giving a clear incandescence; and when sitting some distance from it, there was no mistaking the high degree of radiating effect. With the 13-inch size fire, the consumption of gas is about 25 cubic feet an hour at 2 inches pressure; and with the 10-inch fire, about 19 to 20 cubic feet. The gas and air adjustment has not been altered, as it is believed by the firm, after considerable tests, to be as perfect as it is possible to make it. It will be remembered that the gas and air adjuster is fitted inside the fender; and, to get at it, one has to put one's hand underneath the front of the stove. If the air-inlet were outside the fire, of course cold air would be drawn in; but, by having the inlet inside the fender, and in close proximity to the burner and flame, it is to all intents and purposes confined in a heating-chamber, and so ensures the preheating of the gas and air before entering the mixing-chamber. Another point about the "A.B.C." series. The side boiling burner is found most popular; and its presence is beneficial from the gas consumption point of view.

The same series of fires has been extended by "D" and "E" patterns—designed specially for placing in tiled recesses, or in fireplaces with tiled side panels. The heating features are the same as in the types already described; but, in other respects, they are higher class and more ornate fires for harmonizing with superior surroundings. The "D" fire is made in two sizes; and it has a curved overhanging canopy. The object in this particular fire is to retain the ascending heat in the canopy as long as possible—longer, at any rate, than is possible in a shallow cased fire. In the interior of the canopy, there are studs and hollows, which all afford (as it were) storage for heat; and the result is an extraordinary heating power, which makes the fire suitable for large rooms—such as dining-rooms. The design itself is very striking. In the "E" pattern, we have a handsome fire fitted with a cast-iron back, to put into ordinary fire-places; and this back is preferably finished in antique copper (it can, however, be had in other styles) which does not lose its appearance owing to the heat arising from the fire—an inner canopy protecting against that. The fire has a removable canopy, so that it can be made of copper, brass, or any style to meet the user's taste.

The New "E" Fire.

In addition to the "Porcellanite" colours, all the fires described can be had in art black, steel finish, or antique copper. Regarding the "Porcellanite" enamels, the range of colours has been extended to a dozen and more; the new colours being cream, crimson, old rose, and deep salmon. The cream replaces the white. It is warmer looking, answers all the purposes of white, and does not lose its pristine beauty. The crimson is very attractive. The colour is one the firm have long been trying to attain; and, after considerable experimenting and expense, they have succeeded. The old rose and deep salmon colours are also charming, and will find place in highly decorative apartments.

One or two other points for which special attention is claimed. A new heater is the "Radian" tubular stove, which has a patented air attachment, and gives a high efficiency. This is made in sections; and the object of its design is to get as much thermal duty as possible from the gas consumed prior to the escaping products passing into the flue—the construction being of a character that the cold air is drawn into the stove in such a manner as to be entirely free from contact with the heated interior surface of the stove and the gas itself. The heat travels up one leg across the top and down the other side, and away to the flue; but between the tubes, and forming part of the casting, there is a passage way for cold air, which, flowing up the heated way, has its temperature considerably raised.

PERSONAL.

The position of Chief Distributing Engineer to the Oriental Gas Company (Calcutta), recently advertised in the "JOURNAL," has been filled by the appointment of Mr. L. M. SNELGROVE, of Bradford; and Mr. C. C. BONE, now with the Commercial Gas Company, will act as his Assistant. Mr. Snelgrove, it may be remembered, was for awhile with the Union des Gaz at the Milan Gas-Works—before Mr. Hovey's appointment there.

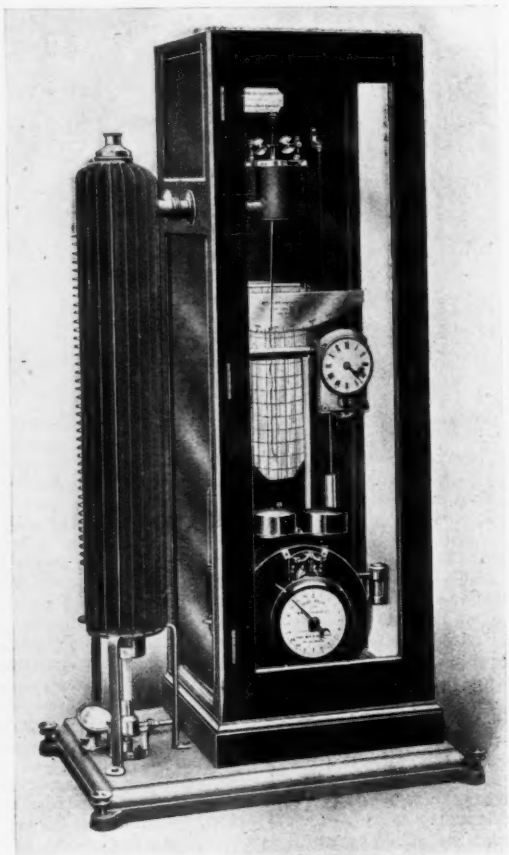
The announcement is made that Sir THOMAS E. THORPE, C.B., F.R.S., who, as was recorded in the "JOURNAL" at the time, received the honour of knighthood on the occasion of the celebration of the King's birthday last June, will shortly relinquish the post which he has held for fifteen years, of principal Chemist at the Goverment Laboratory. Among the many important positions he has occupied may be mentioned those of Professor of Chemistry at the Royal College of Science and President of the Chemical Society, of the Society of Chemical Industry, and of the Chemical Section of the British Association, as well as Vice-President of the Royal Society.

Last Tuesday, at a smoking concert, a presentation was made to Mr. E. D. WOOTTEN, Assistant-Manager at the Burslem Corporation Gas-Works, on his leaving to take up the appointment of Manager and Secretary of the Cockermouth Gas-Works. Mr. Wootten began his career at Burslem, and has held increasingly responsible positions at the gas-works there for the past fourteen years. Councillor T. Mitchell (the Chairman of the Gas Committee) presided over a large gathering, which included the officials and men of the works; and the presentation was made by Mr. Edward Jones, the Engineer and Manager. The gift consisted of a valuable canteen of table plate and cutlery containing ninety pieces. The cabinet bore the inscription: "Presented to Mr. E. D. Wootten by the officials and workmen of the Burslem Corporation Gas-Works as a token of regard and esteem on the occasion of his appointment to Cockermouth, September, 1909."

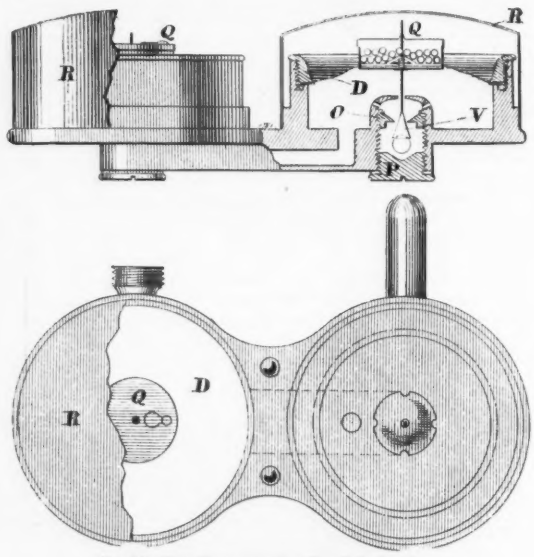
BEASLEY'S RECORDING CALORIMETER.

Description of the Regulating Apparatus.

As long ago as July 30, 1907, and again on Oct. 27, 1908 (in connection with a paper read by Mr. R. H. Bradbury before the Midland Association of Gas Managers), there appeared in the "JOURNAL" fully illustrated descriptions of the Beasley recording gas calorimeter; but Messrs. Sanders, Rehders, and Co., Limited, of No. 108, Fenchurch Street, E.C., call attention to the fact that there have since that time been certain improvements made in the apparatus—which they have named the "Sarco" gas calorimeter. They have therefore forwarded the accompanying photograph of the instrument as now manufactured, together with details and drawings of the regulating apparatus. Before dealing with the latter, it may be convenient to repeat shortly the description of the calorimeter which was given in the earlier number of the "JOURNAL" referred to.



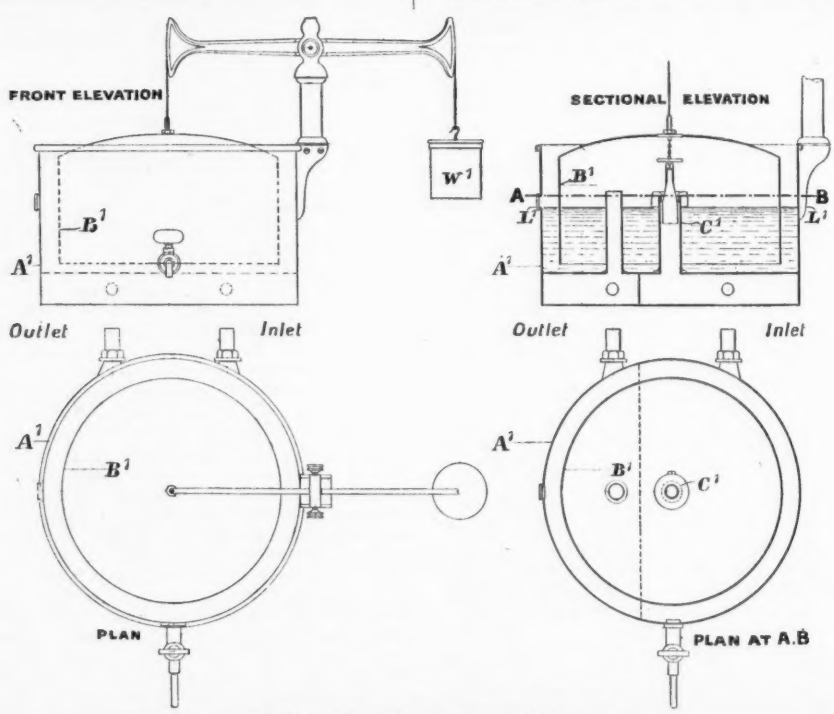
The Latest Form of the Beasley Recording Calorimeter.



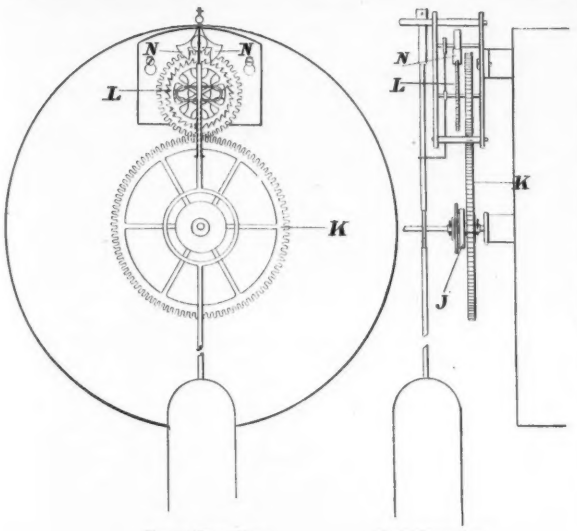
Double Dry Governor for the Calorimeter.

A U-shaped vessel, one limb of which is formed by the annular space between the concentric walls of a vertical chimney, is provided at the top of each limb with a small tank, and contains enough oil to fill the annular space which forms a jacket surrounding the chimney, and also to partly fill the two tanks. The gas to be examined is burned in an atmospheric burner at the bottom of the chimney; and the oil in the hot limb rises to a level above that in the other limb corresponding to the increased temperature. The difference of level is therefore a measure of the calorific value of the gas, and is recorded automatically by means of two weighted floats situated in the tanks, and connected by threads to two pulley-wheels arranged upon a horizontal spindle. The spindle rotates as the floats rise and fall respectively, and operates a lever carrying a pen; the latter tracing a diagram upon a moving band of paper actuated by the clockwork, and ruled with a scale which indicates the net calorific values. The supply of paper for one week's run is wound on a spool; and by means of the clockwork, the paper is drawn over rollers passing behind a scale, and in contact with the marking-pen, to a paper guide, which is sufficiently long to allow the exhibition of about 24 hours' record. To secure a constant stream of gas to the calorimeter, it has been necessary to use a pressure-regulator, and a patent regulating test-meter.

The pressure-regulator is of the double dry type; the rise or



Balance Governor for Power-Gas Calorimeter.



Front Elevation. End Elevation.

Meter Escapement for Calorimeter.

fall of a leather diaphragm D either causing the valve-cone V to move into or away from the knife-edge seating O. Cleaning the valve-cone and seating is easily effected by removing the plug P, and if necessary unscrewing the seating. Two governors are employed; the first reducing the pressure from about 4 inches to 1 inch, and the second to about 8-10ths inch, which is the pressure required to work the regulator satisfactorily. Shot-boxes Q are dropped over the valve-wires, and rest on top of the diaphragms; and by altering the weights, variations in pressure may be obtained. The brass covers R are fitted over the governors in order to protect the leather diaphragms.

The patent regulating test-meter ensures a constant rate of flow unaffected by variation in the specific gravity or any slight frictional or pressure variation of the apparatus; for without this regulator the quantity of gas passing would be controlled by the size of the orifice whence it issues, and the pressure. The rate of flow would consequently vary with the specific gravity of the gas, and so render the record of the calorimeter uncertain and misleading. The measuring-drum of the meter is geared to a pendulum escapement. The drum of the meter drives the escapement just as the spring of a clock drives the clock; and in the same manner as a clock escapement controls the speed of the clock, so the escapement attached to this meter controls the speed of the drum.

The large wheel K is not fixed to the drum-shaft, but to a spiral spring J; the spring itself being fixed to the drum-shaft. Consequently, when the shaft rotates, the spring is first wound up, and then, upon swinging the pendulum, the wheel K, which is in gear with the escapement proper, is set in motion. The object of the spring J is to prevent the momentary stopping, caused by the escapement pallets N engaging with the teeth of the escapement wheel L being felt by the drum.

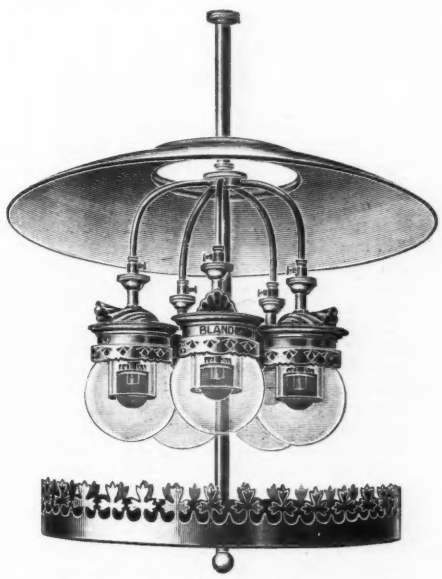
The pressure-regulator used with the producer-gas instrument is of the ordinary wet type; but the dimensions and weights of the different parts have been carefully studied to meet the present requirements. The tank A^1 is filled with water to the level L, and forms a lute to the bell B^1, from the centre of which is suspended by a light chain a somewhat heavy cone. For a normal gas pressure the bell B^1 is counterpoised by the balance-weight W^1. An increase or decrease in the pressure raises or lowers the bell, restricting the gas-passage between the suspended cone and a feather-edged seating in the chamber C^1. The bell, being large, is sensitive to very small changes of pressure; and the regulator as shown will maintain the constant pressure necessary to work the controller, and this against pressure variations from 1 inch to 10 inches in the main gas supply. This form of regulator is found to behave perfectly, even when the cone and seating have been almost covered with tarry matter from producer gas.

North of England Gas Managers' Association.—The sixty-fifth half-yearly general meeting of the Association will be held in the Crown Assembly Hall, Ocean Road, South Shields, on Saturday of next week, Oct. 2, under the presidency of Mr. T. H. Duxbury. The *agenda* includes the Inaugural Address of the President, a presentation to Mr. W. Doig Gibb, and a visit to the Oyston Street works of the South Shields Gas Company. After the meeting, members will dine together at the Golden Lion Hotel.

Association of Engineers-in-Charge.—The Council of the Association have unanimously elected Mr. Henry Adams, M.Inst.C.E., as their President, in succession to Mr. James Swinburne, F.R.S., M.Inst.C.E.; and an attractive programme has been drawn up for the coming session, including some good papers and several social functions. Among the members of the Association, Mr. Adams is one of the oldest engineers-in-charge, having as far back as 1865 been in responsible charge of the outdoor department at Armstrong's Elswick works.

THE "BLAND" LIGHTING SPECIALITIES.

THE principles underlying the large range of Bland inverted burners are well known. To the Bland Light Syndicate, Limited, credit, it should be said, is due for originally introducing certain features that have been approved, and largely adopted in burner manufacture with variations. The lateral outlet for the products of combustion—the outlet being formed by the firm's well-known shell top, which gives protection to the metal connections above and to the primary air supply—has from their very introduction been a feature of the Bland inverted lamps. So has been the use of a regulating needle-nipple for inverted burners; and so



A New Cluster Burner for Church Lighting.

has been the production of an intermediate type of burner, which is so much more suitable for a two or three light pendant for domestic purposes than the large ordinary form, in respect of gas economy, light distribution, and pleasing appearance. Another consideration advanced is that the lamps are all British made, and that they are constructed from solid brass, and are not iron

Ornate Pendants for Single Inverted Burners.

electro-brassed. To the regulating needle-nipple (which is also made of solid brass), the firm have been paying particular attention. They have been working on it to ensure that the needle shall operate positively central in the nipple hole; in order that there may be an even discharge of gas, thus ensuring a good shaped flame. This is now recognized as being an important

condition to excellent illuminating results. Touching upon the needle-nipple, too, those with large experience of the various makes have found that, in some, there is a slight leakage from the shaft by which the needle is operated; and this is apt to be unpleasant. So as to ensure against the inconvenience of this sort of thing, every nipple now sent out by the firm is tested from ordinary up to 14 inches pressure; and not one is passed that is not absolutely gas proof at this pressure. Speaking on this point, the firm know the value of a good reputation; and to maintain this, every burner, we are informed, undergoes individual examination and trial before being sent out.

As readers who have interested themselves in the many types of inverted burners are aware, the firm strongly advocate the suspension of the mantle in the globe carrier. They have experience to justify their preference. Several gas companies have testified to the fact that the cost of maintenance is most reasonable, and, in their opinion, less than the cost when the mantle is placed on the burner nozzle. The only objection is that special mantles have to be used. Suspension as provided for by the firm is credited with the merit of being a great safeguard—the points claimed being that, through the mantle resting loosely within the globe, the vibration of the burner is not transmitted to the mantle, that there is consequently great economy in mantle consumption, and that, the nozzle being brought well into the mantle, the flame is maintained in a central position. But, of course, the choice of a consumer between this method of suspension and suspension from the nozzle can be satisfied.

The firm, in addition to low-pressure burners—ordinary, intermediate, and bijou—for all conceivable lighting purposes have also high-pressure and self-intensifying burners included in their range of productions. In fact, they are making extensions in all directions to meet requirements. In the self-intensifying burner, the gallery is perforated (there is no opening in the globe); and all the air required for the feeding of the bunsen flame is drawn in through the gallery perforations, and travels down between an interior glass and the outer globe, and thus gets heated up to the prevailing temperature before reaching the flame and the mantle. With these self-intensifying lamps, every make of globe and mantle suitable for such a burner can be used. In other words, special glasses and mantles are not necessary. Another feature is that by a patent arrangement inside the bunsen tube, lighting-back is obviated; and in igniting and extinguishing the burner, there is no explosion in the mixing-chamber. The Bland-Graetzin inverted high-power lamps for both indoor and outdoor use are represented by several patterns in the show-rooms. The sizes run from one to five burners; and, the illuminating power being 125 candles per burner, the five-burner lamps will give a light of approximately 625 candles. For the South of England, the firm are also the agents for Thorp's patent combined blower and governor for high-pressure lighting. This plant is small and compact; and very suitable for mills and factories. Any form of motive power, with suitable shafting, will do for running the compressor; and a claim for it is that the constancy of the plant may be fully relied upon whether one or a thousand burners are in use. There is also an automatic arrangement, whereby, should there be a failure of the motive power from any cause, the gas will continue to pass to the burners at normal pressure. An important point when high-pressure lighting is employed in factories where fluff is flying about in the atmosphere, is to have a burner without places affording lodgment for material of the kind; and such a burner has been designed by the Bland Syndicate.

A feature is made by the firm of the lighting by inverted burners of churches and public buildings. A new four-burner cluster lamp designed for use in such buildings is illustrated. It is a handsome-looking arrangement—more so in its actual self than in the pictorial representation; and it is very powerful. These lamps can be readily attached to existing down rods; and, being furnished with a bye-pass attachment to each burner, the clusters can all of them be controlled from any distance by a separate bye-pass supply.

In fittings the firm have some exquisite patterns; and particularly noticeable are the artistic one-light pendants for inverted burners. One-light pendants are not always things of beauty; these are. Just a word as to glassware. Here, too, the firm have a choice of all forms, to suit all purposes, and to meet the most refined tastes in the matter of decorative effects. The glassware is made of "Monopel" heat-resisting glass.

GAS-WORKS EXTENSIONS AT DUNEDIN, N.Z.

Opening Ceremony.

THE last New Zealand mail brings particulars of the ceremony which attended the formal inauguration of extensive alterations and improvements which have been carried out in connection with the gas undertaking of the Dunedin City Council. A tour of inspection of the new works was taken part in by a large number of people, including members of the City Council, the Legislature, the surrounding Borough Councils, and representative citizens. Mr. H. H. S. White (the Chairman of the Gas Committee) presided; and he was supported by the Hon. J. A. Millar, Mr. J. H. Walker (the Mayor), Mr. Robert English (the Engineer to the Christchurch, N.Z., Gas Company, who has acted as Consulting Engineer to the Dunedin Corporation), Mr. J. Hungerford (the Resident Gas Manager), and Mr. R. W. Richards (the Town Clerk and City Engineer).

The work consisted of a new retort-house of twelve beds of through retorts (with settings of Mr. English's own design), equipped with De Brouwer charging and discharging machines; coal-elevators; coke-conveyors and screening plant; new exhausters, of 6000 cubic feet capacity per hour; four 30 feet square purifiers; and a gasholder of a million cubic feet capacity. The foundations of the holder rest on piles driven down 75 feet. In all, 375 piles were used, the tops of which were floated in 1 foot of concrete. Upon this was placed expanded steel, upon this another foot of concrete, and then some old railway irons set in grid-iron fashion; and these were embedded in 2 feet more of concrete.

In connection with the opening ceremony there was some speech-making appropriate to the occasion. The "Loyal Toast" having been honoured,

The MAYOR proposed "Success to the Gas Undertaking," coupled with the names of Mr. English and Mr. R. W. Richards (Town Clerk and City Engineer). He said that he regarded this as a red-letter day in the history of the City Corporation. During the time he had been in the Council and the four years he had been Chairman of the Gas Committee, it was his dream that he would live to see the day when these extensions were completed—extensions which in time to come would prove of great advantage to Dunedin and to the citizens. He might state that he was the sole representative in the Council at the present time who was a member when the works were undertaken; but he would like to add that they had present that day ex-mayors and ex-councillors who, during the time they served in the Council, gave these extensions their heartiest support, and who were to a large extent responsible, with others, in bringing them to a successful issue. They had been especially fortunate in this undertaking in having as their Consulting Engineer Mr. Robert English. As business men embarking on an expenditure of something like £55,000, they thought it only right and proper that they should have an expert to guide them; and they decided to entrust the work to Mr. English, of the Christchurch Gas Company—a decision they had no reason to regret. He might say there and then that the Council and the citizens of Dunedin were deeply indebted to that gentleman for the manner in which he had carried out the work from its initiation. Three years ago that day, Mr. English took charge; and he then said that, in his opinion, the works would be completed in something like three years. And what did they now find? That Mr. English was well within the limit; for the works were really completed two or three months ago. Again, they had to thank him for the works being finished for a little under the amount which he said they would cost. This, he considered, was somewhat of a record. Mr. English estimated the outlay at something like £55,000; and the works at the present time had cost a little over £53,000. He could not conclude without paying his tribute to Mr. Hungerford, in whom the citizens had a most capable Gas Engineer, and a gentleman who had not stinted himself in successfully carrying out the works.

Mr. ENGLISH, in reply, said he sincerely trusted that all their anticipations in regard to the result of the working of the plant would be realized. Personally, he had no doubt they would be. They had the goods at their disposal; and he thought something should be done by the Corporation as to the selling of them—that was, in regard to distribution. He had reported fully to the Council as to what he considered should be done in this direction; and he would like to see the Council follow on the lines he had suggested, in order to show the value of gas, and how it could compete with electric light. He was certain consumers at the present time could get from three to four times better light if the burners were properly seen to. With regard to renewals and alterations, he understood that a good deal of the plant now erected had been charged to loan account. Most of this had been carried out to replace work that had become obsolete or worn out; and some method, he thought, should be adopted by which a renewal fund should be created, so that the loan money would last much longer, and would be a standing charge against revenue. He might say that during his connection with the Corporation, which was now at an end, he had received every consideration. He would like them to consider their Gas Manager, and place their confidence in him; and he was satisfied from the knowledge he had of him that if they did so they would never regret it.

Mr. RICHARDS said his association with the Corporation, in this and every other work, had always been of a pleasing nature. He was glad to hear Mr. English speak of Mr. Hungerford in the way he had done. He hoped their Gas Manager would be given a free hand in these works. He had the capacity; it only required to be developed. They had only to give him the opportunity, and he would be a credit, not only to Dunedin, but to the whole of New Zealand. He hoped that Mr. Hungerford's past services would be recognized by reposing in him the confidence to which his position entitled him.

Mr. WHITE, in proposing "The Gas Engineer and Staff," said that during the time he had been in the Council and a member of the Gas Committee, he had seen a good deal of the Gas Manager; and he unhesitatingly asserted that the Council had no better officer than Mr. Hungerford. He was a Dunedin boy; and they should feel proud that one of their own lads was capable of holding such an important position. He served his apprenticeship, so to speak, with Mr. English, who was recognized as a leading authority on gas matters, not only in the Australasian Colonies, but also in England.

Mr. HUNGERFORD, in reply, remarked that it was the assistance he had received which had enabled him to discharge his duties in a manner that, he trusted, had been appreciated. He had now had control of the works for three years; and he hoped that he had discharged the duties of a somewhat onerous office in such a way as had won the appreciation of councillors—especially those to whom he was indebted for freedom of administration, which he had been fortunate enough to experience. During the execution of the works, he had been assisted by a loyal staff of workmen. The Council should continue their policy in regard to distribution of gas after its manufacture.

Press Cuttings!

The "Versailles"

A New Departure!

Messrs. Arden Hill and Co. are well in evidence with new apparatus for the gas-fire season. Heading their list of novelties is the "Versailles"—a new gas-fire of quite distinct class, the striking feature of which, apart from its very fine design, is the embodying of the makers' new ideas as to greatly enlarging the width of the fire space. This new departure enables any ordinary coal-fire to be replaced by a gas-fire having the same extent of radiating surface, and so removes one more obstacle to the great popularity of the newer apparatus. The "Versailles," which is made in two sizes, 17-inch and 21-inch respectively, provides an amount of firewidth far in advance of anything hitherto attempted in this direction, yet it is claimed that, by its including the "Simplex" shallow-fire principle and the patent "Thermo" firefront, it consumes no more gas than the best ordinary stoves. The fire is chaste and artistic in design; and the makers believe that it will achieve a high degree of popularity among gas consumers as well as among gas authorities.

An Excellent Series

The "Radium"

The "Thorium"

The "Cerium"

All removable parts are common to each fire & therefore Interchangeable

Three Slot-gas Fires

The winter season of 1907-8 was marked by the introduction of Messrs. Arden Hill and Co.'s "Radium" stove—a "Slot" gas-fire, which quickly earned a high reputation for itself as being an ideal fire for hiring-out purposes. This fine effort in stove design has been followed up this season by the introduction of two other similar fires—one, with square top, named the "Thorium," which is made in three sizes, with firewidths of 8½, 10, and 14 inches respectively, the other—a nursery fire—is named the "Cerium." The latter is made in two sizes, 10-inch and 14-inch. It is listed at quite a moderate figure, and is thoroughly up-to-date in every detail. Thus a series of three excellent slot gas-fires is provided wherein all the removable parts are common to the three fires, and therefore interchangeable, as has been the case with a number of the firm's fires for a period of years.

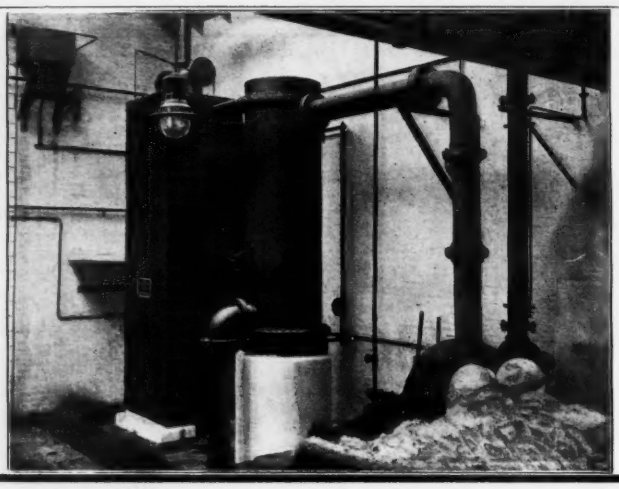
Arden Hill & Co
Acme Works
Birmingham

The Basket fire up to date

The "Adept"

Another novelty which cannot fail to be of interest is the "Adept." This is a new basket fire (for which a patent has been applied for), which, taking as its point of departure the old-fashioned "basket" fire, is intended to compete with the most modern fires hitherto introduced. It is fitted with the "Thermo" patent and the "Simplex" shallow-fire arrangement; and a special feature, of no small importance, is a patent adjustable grate-front which may be had with the stove. This can be raised or lowered to hide the ash-pan opening of the coal-grate. When raised, it is held in place by two screw knobs. Messrs. Arden Hill's fires are being fitted this season with the (1909) patent form of "Simplex" gas and air adjuster (as described and illustrated last week, p. 630), whereby a perfectly graduated adjustment between minimum and maximum limits is provided without the employment of screw threads and consequent leakage. The new "Simplex" secures equally unimpeded pressure at all points.

The firm have also introduced a new invention for preheating the gas before it enters the burner, by which the radiant heat is thus greatly increased. This contrivance can be fitted to the "Versailles" fire at a small extra cost.



W. C. HOLMES & Co.,

LONDON,

And Whitestone Iron Works,

HUDDERSFIELD.

SULPHATE OF AMMONIA PLANT

recently erected at

WALLASEY GAS-WORKS.

NOTICE.

Full Particulars regarding the MERRIFIELD-WESTCOTT-PEARSON Water Gas Plants may be had on application to the Patentees at

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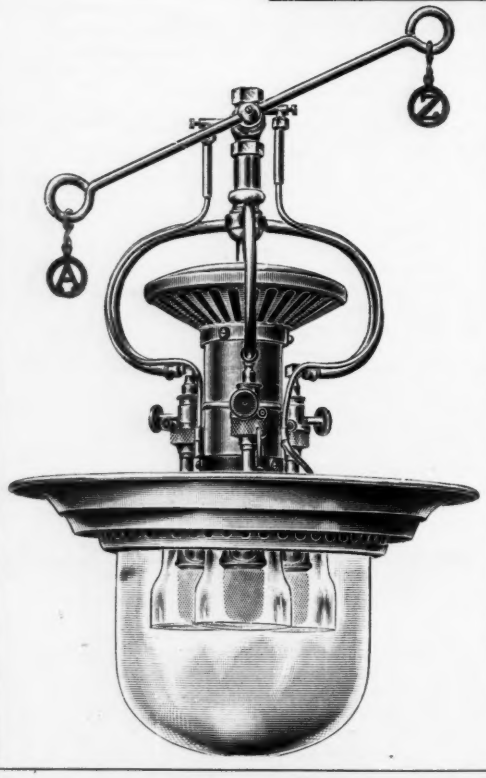

White Enamelled with Gold Lines.
Brass Lacquered Gas-Tubes.
Fitted with Gas and Air Adjusters to Burners.
Easy access to Bunsens.
Lighting capacity about 125-Candle Power per Burner.

Price complete (as shown).

12247. With Clear Bowl, Cylinders, and "GLASMI" XX Mantles.

2-light,	3-light,	4-light,
46s.	**55s.**	**68s.**

each. Subject to our usual discount.

NOTE.—The 2 and 3-light Lamps take same size Bowl as used on the 2-light Graetzin Lamp, and the 4-light Lamp takes same as 3-light Graetzin Lamp.

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both for Indoor and Outdoor Lighting.

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THE "FELD" PLANT AT EAST HULL GAS-WORKS.

In view of the forthcoming meeting of the Eastern Counties Gas Managers' Association at Hull—when the members will, on Friday, inspect the works of the East Hull Gas Company—Mr. John Holliday, the General Manager and Engineer of the works, has prepared for circulation among the members prior to the visit an account of the Feld plant he has in operation for the elimination of sulphuretted hydrogen and the recovery of the sulphur as a bye-product. Mr. Holliday has kindly forwarded a copy of this description for inclusion in this week's issue of the "JOURNAL."

The plant consists essentially of two of "Feld's" centrifugal washers, through which the gas passing meets with a stream of washing liquor. Intimate contact then takes place, owing to the centrifugal action of the machines; the gas passing through a series of sprays of the liquor. The remainder of the plant (as shown on the diagram) is for the regeneration of the washing liquid, and the ultimate recovery of the sulphur.

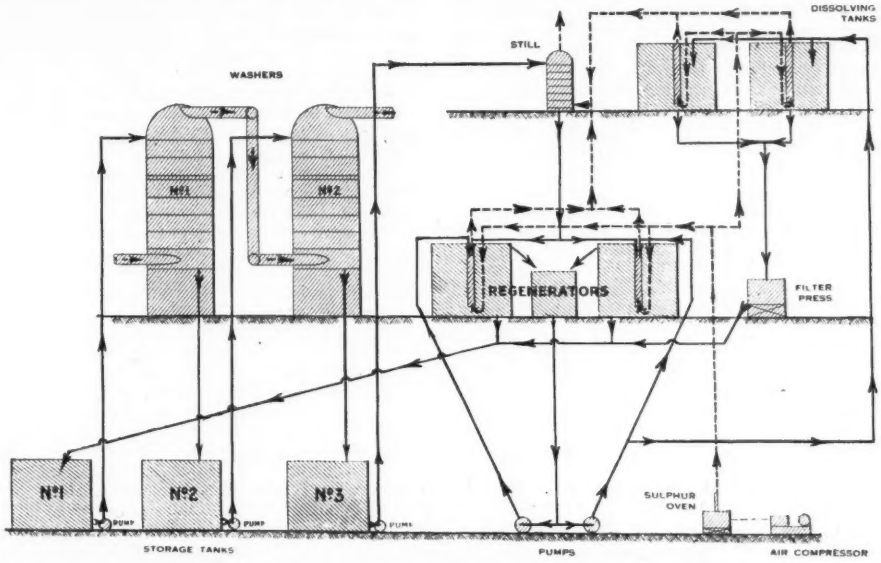
The active reagent used in the plant is zinc thiosulphate. To commence the plant, a quantity of zinc oxide is placed in one of the "dissolving" tanks, and the tank is filled with water—the zinc oxide being held in suspension by the action of mechanical agitators, with which each of the tanks is provided.

Sulphur is burnt in the sulphur oven indicated; and by passing air (from the air compressor) over it, sulphur dioxide gas is formed. This sulphur dioxide gas then passes through the dissolving tanks, meeting at this point the zinc oxide in suspension. The excess of sulphur dioxide from the tanks is passed through the "still," which is referred to later.

By the action of the sulphur dioxide on the zinc oxide, zinc sulphite is first of all formed in the "dissolving" tanks. This solution of zinc sulphite is treated in the washers with sulphuretted hydrogen from the crude gas—forming zinc sulphide. This latter again is treated in the dissolving tank with sulphur dioxide, forming zinc thiosulphate.

These reactions only take place at the first commencement of the plant. When all the zinc oxide has been acted upon—*i.e.*, converted into zinc thiosulphate (the latter being in solution)—the liquid is run into No. 1 storage tank. From No. 1 tank it is pumped into No. 1 washer, meeting the gas which is flowing in the opposite direction.

This washing liquor—*i.e.*, zinc thiosulphate—reacts with the



[The dotted arrowed lines indicate the passage of the sulphur dioxide gas; the full lines, that of the washing liquor.]

General Arrangement of the Feld Plant at the East Hull Gas-Works.

sulphuretted hydrogen contained in the gas, forming zinc sulphide and free sulphur; these two latter being present in the liquor as precipitates. [It must be remembered that zinc thiosulphate is always in excess.] From No. 1 washer, the liquor flows by gravity into No. 2 storage tank; and from this tank it is pumped into No. 2 washer, and then flows into No. 3 storage tank.

About three-fourths of the total quantity of sulphuretted hydrogen contained in the gas is extracted in No. 1 washer; the remaining portion being eliminated in No. 2 washer.

The liquor in No. 3 storage-tank now contains zinc thiosulphate, zinc sulphide, and sulphur; the former being in solution, while the two latter, as stated, are in the solid state as precipitates.

From No. 3 storage tank, the liquor is pumped into the "still," and flows from this into one of the two "regenerator" tanks. Sulphur dioxide is passed through these "regenerators," as indicated; the excess passing through the "still," and the waste innocuous gases into the atmosphere. From the "regenerator" tanks, the liquor overflows into an overflow tank; and from here it is pumped back again into the "regenerator." This operation is continued until the liquor is again ready for use.

The process of regeneration consists in converting the zinc sulphide into zinc thiosulphate by the action upon it of sulphur dioxide.

On the completion of this part of the process, the liquor is run off into No. 1 storage tank; and the cycle of operations previously described again takes place.

When the liquor in No. 3 tank contains about 15 per cent. of sulphur, it is pumped into one of the overhead "dissolving" tanks, and is here again treated with sulphur dioxide until the whole of the zinc sulphide is formed into zinc thiosulphate. The liquor, &c., is then passed through the filter press, where the sulphur is recovered in a solid form, and the filtrate (zinc thiosulphate only) flows back into No. 1 storage tank to be reused for washing the gas. This enables the sulphur to be recovered, uncontaminated with zinc sulphide.

All the various tanks are provided with overflows delivering into No. 1 storage tank; so that in the event of the attendant closing a wrong valve, no portion of the plant will be subjected to undue pressure—thus preventing accident. There is a relief-valve fixed between the air compressor and the sulphur oven for a similar purpose.

Air can be forced at will through either of the regenerators or dissolving tanks, to assist the agitation of the liquors.

Part of the sulphur recovered from the gas is burnt in the sulphur oven to sulphur dioxide, and is again recovered as sulphur during the process.

THE STORAGE OF GAS COAL.

By Herr PRENGER, Manager of the Cologne Gas-Works.

SOME particulars were given in the course of the report in the "JOURNAL" for June 29 last (p. 967) of the proceedings at this year's general meeting of the German Association of Gas and Water Engineers of the paper which was presented to the meeting by Herr Prenger, the Engineer and Manager of the Cologne Gas, Electricity, and Water Works, on the Storage of Gas Coal. The paper has now been published in full in the "Journal für Gasbeleuchtung," and it will be useful to give a more exhaustive summary of its contents.

The storage of coal is a most important question for gas-works—having regard to its effect on the gas-yielding properties of the coal, and to the losses which may be incurred through spontaneous ignition. Further, it has to be decided whether capital expenditure on covered coal-stores is justified by the benefit accruing from storing the coal under cover as compared with storing it in the open. The views held by gas managers on these and cognate points relating to the handling and storage of gas coal, are so extremely divergent that it seemed expedient to the Council of the German Association of Gas and Water Engineers that an attempt should be made to collect from the managers of a large number of gas undertakings information as to their experience and views on the more important of these points. A series of questions was therefore (as already reported in the "JOURNAL") drawn up and duly issued by the Association; and the answers

received have been placed in Herr Prenger's hands for collation with a view to a summary and a report being prepared. Herr Prenger, however, has not dealt comprehensively with the results of all the inquiries in his present paper, which is intended rather to draw attention to the diversity of views held, and to the importance of obtaining further trustworthy observations upon most of the points involved in the question of the storage of gas coal. Naturally much depends on the local conditions and on the descriptions of coal handled; and bearing this in mind it is not proposed in this summary of Herr Prenger's paper to go fully into the parts of it which have but little bearing on the storage of coal in conditions prevailing in English gas-works.

It is pointed out that the ideal state of coal supply being regulated precisely to the works' demands, no longer exists on gas-works, and that the larger gas undertakings at least must make provision for the storage of considerable quantities of gas coal. For instance, the output of the pits has, for economy of working, to be maintained at a tolerably uniform level, summer and winter; and the coal factors naturally desire gas-works to accept deliveries in the summer of more coal than is needed for their immediate use, with a view to having a surplus in hand for the enhanced winter requirements. Such equalization of deliveries demands, according to Herr Prenger, storage accommodation on the gas-works for 18 to 20 per cent. of the annual consumption of coal. Taking into account also the necessity of providing for failures of supply—owing to strikes of miners, interruptions in transport due to scarcity of railway waggons, stoppage of waterways by frost, &c.—the conclusion is drawn that storage space must be provided for from 30 to 35 per cent. of the year's requirements of gas coal. [English gas men, however, should bear in mind that Herr Prenger is basing his estimate on German conditions of coal-transport—*i.e.*, with the notorious insufficiency of waggons provided by the State railways, and with winter frosts such as are not experienced in England.] The Westphalian Coal Syndicate, moreover, offers coal generally for summer delivery at about 1s. a ton less than for winter delivery. Against this saving in cost, has to be set the loss of interest, the depreciation of the coal by storage, and the cost of handling the coal in store. These charges vary with the conditions of each works; but they must be taken into very serious consideration when a new gas-works is being erected or an old one extended—especially in relation to the question of storage in the open or in covered sheds. The latter may be provided in small works, where there is no idea of mechanically handling the coal, at comparatively low cost; but with large works this is not the case. In Germany, storage under cover is generally preferred. Out of 183 gas undertakings (many of them with more than one works) which have replied to the questions issued, 141 have wholly or mainly covered coal stores, and only 42 store their coal entirely in the open.

The risk of fire through spontaneous ignition is a very serious feature of coal storage. Notwithstanding the mass of literature on the subject, there is still great diversity of opinion as to the bearing of the depth of the stacks or heaps of coal, and of ventilation or absence of ventilation of them, on liability to ignition. Hence it is eminently desirable that every opportunity should be taken of discussing the matter, with a view to arriving at definite conclusions on these points. It may be taken as settled that the spontaneous ignition of coal is due to the rise of temperature caused by oxidation of the coal by the oxygen of the air. This process begins in the pit as soon as the coal is removed from its seam. The amount of oxygen absorbed varies with different coals; but the more it is, the greater is the chance of ignition. The danger increases with the area of the surface exposed relatively to the quantity of coal; and hence it increases with the fineness of division of the coal. When coal is stored in deep stacks, the pressure causes crumbling of the lower layers, and often fires have originated in them. But this is not the case to an exceptional extent; and statistics show that fires break out at all depths and even in shallow stacks of coal. For instance, coal has ignited at Cologne, at a spot about 3 feet below the surface, in heaps over 12 feet in depth. At other times, fire has broken out in the middle or near the bottom of the stored coal, but in all cases near the walls of the store, where, in discharging, the large coal had lodged and air had consequently readier access to the interior.

Having regard to this observation, the author believes it to be a mistake to provide ventilating passages. This view is supported by the experiences of several engineers who have found that ventilating pipes in the walls of the store favoured heating of the coal. On blocking-up these pipes, they had no further trouble from spontaneous ignition. The pipes favoured the heating-up of the coal, and acted as flues in the event of it igniting; they did not afford an energetic and uniformly distributed ventilation of the whole store of coal. Such ventilation can without doubt have good results. It has been carried out most effectively in the coal stores at Zürich and Bremen, where Saar coal is stored to a depth of 33 feet, and English coal to 20 to 23 feet, without considerable rises in temperature or ignitions occurring. The depth to which coal is stored varies greatly in different gas-works. It ranges from 10 to 30 feet for Ruhr, English, and Silesian coals, and reaches even 33 feet with Saar and Saxony coals without any very special troubles arising.

The risk of ignition is greatly favoured by the amount of dust and moisture in the coal, especially if there is also pyrites present. Quite a large amount of water closes the pores of the coal, and by protecting it from access of air reduces the danger of ignition. Moisture, however, favours the decomposition of the pyrites, and hence causes a rise of temperature, which in turn increases the capacity of the coal for taking up oxygen, so that the heating effect is cumulative and may result in ignition. It is, however, well known that the nature of the coal is of material significance. The replies to the questions issued show that fires and considerable heating of the coal are almost confined to English and Westphalian coals. In the course of twenty years 183 gas undertakings have experienced fires in only 49 works. English coal is responsible in 26 cases and Ruhr coal in 23 cases; while there have been only two fires with coal from Saxony, and one with Silesian coal. Storage in the open or under cover does not appear to have much bearing on the chance of ignition, though the former condition seems to dispose somewhat to greater risk of heating. Of the fires with English coal, 15 were with stores in the open and 11 in sheds; whereas with Ruhr coal 7 fires occurred in the open and 16 with coal stored under cover. For the avoidance of fires, it appears desirable to store coals of different origin separately, and to work off first that which is most disposed to spontaneous ignition. In the author's opinion, this ignition is due to the fortuitous co-operation of a number of different factors, such as the size of the coal, its moistness and composition, and in particular the amount of sulphur it contains. These factors vary greatly with different coals, and are also affected by the local conditions. Reports agree, however, that coal which is permeated with dust is more prone to spontaneous ignition, especially if a pocket of dust occurs in the midst of layers of lump coal through which the air can get access to it. Fires are less liable to occur with closely-packed coal or with clean screened lump coal or washed nuts.

It is also important for the avoidance of fires that the temperature of the coal in the store should be observed by means of thermometers placed in thin iron pipes inserted in the coal. If the temperature rises more than 90° Fahr., most authorities recommend the removal of the upper layers at least. Covered stores should be divided by walls into separate compartments, so as to avoid a fire spreading to a great extent. Iron columns and ties of conveying plant are said to favour the spread of fire; and they should therefore be jacketted with concrete. Dry coal only should, if practicable, be stored; and any damp coal should be used as soon as possible. The oldest coal should be used first, to avoid further depreciation. The provision of ample mechanical appliances, by which the coal in store may be quickly removed, is a great protection against serious loss through fire.

The question of the depreciation by storage of the coal for gas-making naturally affects the decision as to whether the fresh deliveries of coal should be used first, whenever practicable, and as to the length of time that coal may be kept in store. Obviously, it is desirable to avoid the cost of transporting the coal to and from the store when this is feasible. It is, however, eminently desirable that trustworthy information should be obtained as to the changes which the coal undergoes in course of storage; and this question might advantageously be taken up by the German Association's experimental works. It is, however, generally acknowledged that the yield of gas rapidly begins to diminish more or less, and that the diminution increases greatly with the duration of the storage. Thus, Grundmann has given figures, showing for Ruhr coals reductions in the yield of gas of 0·9 to over 7 per cent. on storage for only 14 days; of 3·2 to 12·0 per cent. in 150 to 160 days; and of 8·1 to 17·2 per cent. in 370 to 381 days. Experiments reported from the Konigsberg Gas-Works in 1904-5 showed the following yields of gas from New Leverson coal, in cubic feet per ton of dry coal:—

Fresh from the steamer	10,873 cubic feet.
After storage for three months . . .	10,815 ,,
,, ,, ,, seven ,, ...	9,929 ,,

The falling off in seven months in this case, therefore, amounted to 8·6 per cent.

The diminution in value of the coke is a very important point in connection with the storage of coal. Storage of the coal reduces its caking qualities, and so renders the resultant coke small and dusty. There is also considerable decrease in heating value. In Cologne, the coke from stored coal has been found to be useless as fuel for producer furnaces, which, after being charged for three or four days with it, have to be cleared out. There is no alternative but to use coke from fresh coal. The mixing of stored with fresh coal is troublesome, and attended with some expense. A number of other gas-works have had the same experience. The coke from the stored coal naturally sells with greater difficulty, and is apt to occasion complaints. The extent of the decrease in value of the coal depends greatly on its description. Most of the returns received from gas undertakings refer to Ruhr coals. According to the particular coal used, the diminution is reported to range from 0·5 to 6 per cent. on an average make of (say) 10,765 cubic feet per ton. This is when the coal is stored under cover. After 2½ years' storage, the make is reduced by 16·6 per cent. The loss is appreciably greater when the coal is stored in the open. The figures reported range from 2 to 15 per cent., according to the length of storage. In one case, 25 per cent. reduction was found after several years' storage. The average figures for Ruhr coal stored for one year are, if in sheds, 2·1 per cent., and if in the open 5·4 per cent., falling off. Thus there is a difference of 3·3 per cent. in favour of storage under cover. For English coal, stored in the open, the loss ranges from 3 to 15 per cent., and averages 7 per cent.; while for this coal stored in sheds, the loss is between 0 and 10 per cent.—averaging 4 per cent. Several large works,

however, report that the loss in gas making value of English coal by storage is not specially great. A reliable investigation of this point seems very necessary. The results for Saar coal are tolerably concordant, and show an average loss of only 3·3 per cent. with storage in the open, and of 1·6 per cent. with storage in sheds. Coals from Silesia and Saxony show an average loss of 4 per cent. With the latter it appears to matter little whether they are stored in the open or under cover. Provisionally, the general conclusion may be drawn that it is undesirable that coal should be stored for more than a year at the outside.

Only a few observations are available on the change which coal undergoes by long storage. At Cologne, the mixture of Ruhr coal commonly used showed a falling off in calorific power, by storage for 1½ years in stacks 10 to 13 feet high, from 12,571 B.Th.U. per lb. to 11,885 B.Th.U.; while the proportion of ash in it rose from 11·70 to 12·81 per cent. The moisture fell from 3·05 to 2·26 per cent. At Quedlinburg, an increase in the proportion of ash from 10·30 to 15·47 per cent. was obtained, and a decrease in calorific power from 12,600 B.Th.U. to 11,448 B.Th.U. per lb. In this case weathering caused the moisture to rise from 2·15 to 5·09 per cent. At Düsseldorf, a falling off of 5·5 per cent. in the calorific power of the gas obtained from the coal has been found through storage of the coal; and the water in the coal has increased by 25 per cent., necessitating an increase in the expenditure of fuel for carbonization of 11 per cent. Researches made at Königsberg, reported in 1906, show quite clearly the destructive effect of great humidity of the coal when it is exposed in the open in hard winters. The moisture in the coal rose from 2 or 2·5 per cent. to 11·06 per cent. after storage for one winter, and to 13·31 per cent. after two winters; while the yield of ammonia fell from 0·222 to 0·102 per cent. of the weight of dry coal. The make of gas was diminished by 15 per cent. On the other hand, different results have been obtained at the Breslau Gas-Works with screened German coal. The make of gas fell, through storage in the open for 1½ years, from 10,909 to 10,547 cubic feet, at 60° Fahr. and 30 inches, per ton; while there was a rise in the yield of coke from 65·66 to 66·23 per cent., of tar from 4 to 5 per cent., and of ammonia from 0·317 to 0·327 per cent. The proportion of ash in the coal rose from 2·33 to 3·93 per cent. on the dry basis, while the gross calorific power of the gas made became 597 B.Th.U. in place of 592 B.Th.U. per cubic foot, and the net 536 B.Th.U. in place of 535 B.Th.U.

The following results obtained at Breslau Gas-Works with coal from the "Königin Louise" mine (Silesia) are also interesting.

Carbonization of "Königin Louise" Coal.

Condition of Coal.	Fresh and Screened Lump Coal.	Fresh but Unscreened Coal.	Weathered Through Prolonged Exposure
Ash in the dry coal, per cent.	4·22	5·12	6·07
Make of gas per ton. Cubic feet, at 60° Fahr. and 30 inches	12,032	10,817	9,026
Gross calorific power of gas. B.Th.U. per cubic foot	591	586	580
Yield per Cent. by Weight.			
Coke—			
Large	93·28	86·06	52·73
Small	4·45	8·77	18·91
Breeze	2·27	5·17	28·36
Tar	5·94	4·77	4·75
Ammonia	0·309	0·191	0·252

These figures show in particular the great decrease in the value of the coke caused by weathering of the coal.

In every case the particular conditions must be carefully considered. It must not be assumed that because machinery generally, or some particular machinery, has answered well in one works that it should therefore be adopted in another. There are limits to the economical use of mechanical appliances for handling coal; and in some cases manual labour will prove cheaper. The relations subsisting between the gas undertaking and the workmen, however, may often decide the question in favour of machinery, apart from other considerations. For large works, a coal-store equipped with machinery must always be right and economical, notwithstanding the high cost of erection and maintenance. The great convenience of electricity for driving the conveying plant, coupled with the cheapening in the cost of current to ½d. to 1¼d. per unit, must lead to its adoption for handling coal in stores. It is, however, practically impossible to compare the cost on different works of storing coal, or even on the same works when the coal is handled partly by machinery and partly by hand, because of the difficulty of separating clearly the expenses which should be charged to coal-handling and storage and those which should be included in retort-house charges.

The decision will depend on whether it is hard coal little affected by exposure to the weather or coal of which the composition and value are easily altered by weathering. At Cologne, experience had taught that it was desirable to have a covered store for the mixture of about twelve different kinds of Ruhr coal ordinarily used there. Taking interest on the capital outlay at 6 per cent., the storage under cover costs 5·4d. per ton; while the reduction in the value of the coal (thereby avoided), disregarding the deterioration of the coke, amounts to at least 6½d. per ton. There is, further, the great convenience of the handling of the coal under cover, so that the work may be carried on irrespective of weather conditions, and also the advantage that the retorts can be supplied with uniformly dry coal. Covered coal-stores are particularly valuable for works which, owing to their distance from the coalfields, pay a high price for coal, and therefore suffer greater loss through deterioration in its gas-making value.

A great deal has been written of late on the storage of coal under water. The oxidation of the coal is thus avoided, or greatly diminished. The method has been applied on a large scale in America, but chiefly to steam coal. It presents, however, obvious advantages in that it prevents deterioration through oxidation, avoids the risk of ignition, and admits of the coal being stored to any desired height without crumbling. For the latter reason, the area required for storing a given quantity can be reduced. For gas making in ordinary retorts, the coal so stored would be too wet unless it were partially dried before use. Nevertheless, gas-works which are compelled to store coal for long periods might find the method worth adopting. The choice of it must, however, be settled by the local conditions. It is satisfactory to note that the Stettin Gas-Works are about to make provision for storing under water 20,000 tons of English gas coal. The store will be on the bank of the Oder; and the coal will be transferred direct from the ship to the store. This installation should therefore afford valuable information in the course of a few years on the utility of wet storage when applied to gas coal. It must, moreover, be remembered that wet coal, direct from the store, could be carbonized without difficulty in large carbonizing chambers and vertical retorts.

The present tendency to buy coal only under guarantee of a certain calorific power, or maximum content of ash, promises to lead ultimately to washed coal being bought for carbonizing, in place of unscreened coal as won from the pits. This course will also be favoured by the adoption of vertical retorts, which carbonize damp coal satisfactorily. Trials of freshly-washed smalls, mixed with large coal, which have recently been made at the Cologne Gas-Works, have given satisfactory results.

Discussion of the Paper.

A brief discussion of the paper took place at the meeting; and a summary of the more important remarks is appended.

Herr Kordt, the Manager of the Düsseldorf Gas-Works, said that it was agreed that it was advantageous to gasify the coal when it was as fresh as possible, and at Düsseldorf 78 per cent. of the coal was carbonized without being stored. Of the remaining 22 per cent., some was stored in sheds and some in the open. Some of the latter was at times stored for 15 months. It was found that coal which had been stored for 15 months in the open showed a deterioration of 1·7 per cent. in the make of gas; and the fuel consumed in the retort-furnaces had to be increased by 10 to 11 per cent. On the basis of these figures, it had been decided not to erect covered coal-stores when the time came for extending the works, and to store coal only in the open. It had been found that the coal was more prone to heat up when stored under cover than in the open; and it was more difficult to get at the seat of the fire when the coal was in sheds.

Herr Terhaerst, the Manager of the Nuremberg Gas-Works, said that he attached great importance to the stacks of coal not being too high. The crumbling of the coal was much greater when it was stored to a depth of (say) 33 feet than of (say) 13 feet.

Mr. E. Körting, the General Manager of the Berlin works of the Imperial Continental Gas Association, said that he had found by experience that fires in stored coal could be very readily extinguished if ample quantities of water were available. In the event of fire, it was his practice to have a hole dug in the top of the heap of coal and water poured into it until it ran out from the bottom of the heap. In the second place, if the coal is discharged at the apex of the heap, the large coal runs to the outside and the small coal accumulates in the middle of the heap. It is in the small coal that fires break out. Herr Schimming, of Charlottenburg, had pointed out years ago that the coal should be spread out in layers as the heap is being built up, so that the small and large coal are not separated. By following this plan, English coal had been stored at Berlin through a whole year, in stacks 46 feet high, without firing taking place.

Dr. H. Bunte, Professor at the Technical College at Carlsruhe, said that the effect of storage on coal had already been studied to some extent at the Experimental Works of the German Association. Coal had been tested before and after being stored for a given time; but these tests referred only to a particular set of conditions. The opportunity had therefore been taken of a meeting a short time before of about 40 chemists from various German gas-works, to ask them to give special attention to the question on their own works, with a view to reporting their observations to the Association. By their co-operation information would be secured for very varied sets of conditions. A number of chemists had agreed to collaborate in making investigations—viz., Herr Eitner, of Carlsruhe; Herr Drehschmidt, of Berlin; Herr Allner, of Dessau; Herr Leisse, of Cologne; Herr Funk, of Charlottenburg; Herr Hohensee, of Saarbrücken; and Herr Leybold, of Hamburg. By the aid of these and other chemists, with the co-operation of the gas undertakings with which they were connected, it should be possible in the course of a year or two to form definite conclusions as to the effect on gas-coal of storage under various conditions.

ILLUMINATION & ILLUMINATING ENGINEERING.

By Dr. C. P. Steinmetz.

[Extracts from a Paper read before the New York Section of the Illuminating Engineering Society.]

Artificial light is used for the purpose of seeing and distinguishing objects clearly and comfortably, when the daylight fails. The problem of artificial lighting therefore comprises consideration of the source of light, the flux of light issuing from it, the distribution of the light-flux in space—that is, the light-flux density in space, and more particularly at the illuminated objects—the illumination, or the light-flux density reflected from the illuminated objects, and the effect produced thereby in the human eye. The light-flux entering the eye is varied in its physical quantity by the reaction of the eye on light-flux density in contracting or expanding the pupil. The effect of the light-flux which enters the eye is varied by fatigue, which depends on the intensity and also on the colour of the light.

The physical quantities with which one deals in illuminating engineering are therefore: The intensity of the light-source or the illuminant, and its brilliancy—that is, the flux-density at the surface of the illuminant; the flux of light, or the total power of visible radiation issuing from the illuminant; the light-flux density, or the distribution of the light-flux in space; and the illumination, or the light-flux density issuing from the illuminated objects.

The intensity of a light-source is measured in candles. Very frequently the intensity of a light-source is different in different directions, and then either the distribution curve of the light intensity is required for characterizing the illuminant, or use is made of the average of the intensities in all directions in space—called the "mean spherical intensity." The unit of light intensity, or the candle, is the intensity which produces unit-flux density at unit distance from the light-source, and thus produces a total flux of light equal to 4π units — the surface of the sphere at unit distance from the light-source. The unit of light-flux is called the "lumen," and one candle of light-intensity thus produces 4π lumens of light-flux. The light-flux is the essential quantity which characterizes the usefulness of an illuminant; and it is the raw material from which all illuminating engineering starts.

Light-flux density is the light-flux per unit area traversed by it, and is therefore measured in lumens per square metre (or square foot), just as the magnetic density is measured in lines of magnetic force per square centimetre. In illumination, use is made of the metre and not the centimetre as the unit of length. Frequently also the foot is used as the practical unit of length. For a point source of light, the light-flux density is the intensity of the light-source in candles—in the direction towards the point of observation, if the distribution is not uniform in all directions—divided by the square of the distance, in metres or feet; and the light-flux density is therefore frequently expressed in metre-candles or foot-candles. Thus at 10 feet distance from a 16-candle lamp, the light-flux density is 0·16 foot-candle, or 0·16 lumens per square foot. Very commonly, therefore, the light-flux density produced by sources of light which are not points, is also expressed in metre-candles or foot-candles, which numerically is the same value—that is, the same quantity—as lumens per square metre or square foot, but physically would refer to the equivalent candle power of the light-source.

Illumination is the light-flux density reflected from the illuminated object, and therefore is measured also in lumens per square metre or per square foot, or in metre-candles or foot-candles. Brilliancy is the light-flux density at the surface of the illuminant, and therefore could also be measured in lumens per square metre or square foot. As this unit would usually give enormous values, the brilliancy of the light-source is generally expressed in lumens per square centimetre or per square millimetre. It is a quantity which is of high importance mainly in its physiological effect.

Light-intensity, brilliancy, and light-flux are therefore characteristics of the illuminant, while flux-density is a function of the space traversed by the light-flux, but not of the source of light. With the same source of light, in the space from the surface of the illuminant to infinite distance, all light-flux densities exist between the maximum at the surface of the illuminant and zero. The brilliancy is therefore the maximum of the light-flux density. While intensity and brilliancy depend upon the shape of the illuminant, light-flux is independent thereof. Illumination is a quantity which depends not only on the source of light—that is, light-flux and flux-density—but also on the illuminated objects and their nature, and thus is the light-flux density as modified by the illuminated objects.

The light-flux, as already remarked, is the raw material with which illuminating engineering starts; and the first problem is to distribute the light-flux through space so as to give at all points the light-flux density required for satisfactory illumination. Some problems, such as the lighting of a meeting-place, school room, &c., require a uniform or general, and fairly high, intensity of illumination; while others make a uniform but fairly low illumination desirable, such as street lighting. In other cases, mainly a local or a concentrated illumination is needed. Usually, however, a combination of a local illumination of fairly high intensity, with a general illumination of lower intensity, is required. The former is used at those places where it is necessary to distinguish details; while general illumination is used merely for orientation in the space, and thus may be of lower intensity. For reasons of economy, and also for physiological reasons, the general illumination should be of lower intensity.

It is necessary, therefore, to distinguish between local or concentrated and general or uniform illumination, and a combination of both, and to distribute the light-flux in accordance therewith. That is to say, it is necessary to produce a high flux-density at the points or areas requiring high concentrated illumination, and a low and uniform flux-density throughout the remaining space. The result can be accomplished by choosing a light-source of the proper distribution curve. For instance, in street illumination one would use a lamp giving most of the light-flux between the horizontal and 20° below it. In many cases of indoor illumination, he would use a light-source giving most of the light between the vertical and an angle of from 30° to 60° from the vertical, depending on the diameter of the area of concentrated illumination and the height of the illuminant above it. The result can also be obtained by modifying or directing the light-flux of the illuminant by reflection or diffraction and diffusion, either from the walls and ceilings of the illuminated area, or by attachments to the illuminant, such as reflectors, diffusing globes, diffracting shades, &c. Furthermore, the required flux distribution can be secured by the use of a number of illuminants; with a larger area this arrangement is usually necessary.

Frequently, the desired flux distribution is produced by using an illuminant giving more light-flux than necessary; the excess of flux in those directions where it is not wanted being destroyed by absorption. Obviously, this arrangement is uneconomical, and represents bad illuminating engineering. The desired flux distribution should be secured economically—that is, without unnecessary waste of light-flux by absorption, which usually can be done by employing a combination of a number of light-sources of suitable distribution curves. The most economical method of securing the desired distribution curve is obviously to choose a light-source having a distribution as near to the desired value as possible, and then modifying it by reflection or diffraction.

The problem defined above is one of physics, and the result—that is to say, the objective illumination—can be measured by a photometer or illuminometer, and checked thereby. The duty of the illuminating engineer, however, does not end here; for with the same objective illumination—*i.e.*, the same distribution of light-flux throughout the entire illuminated area, as measured by the photometer—the illumination may be very satisfactory or it may be entirely unsatisfactory, depending upon whether the physiological requirements are satisfied or are violated. Very often one finds illuminations which are entirely unsatisfactory, tiring, or uncomfortable, and yet which judged by the density and distribution of the light-flux should be satisfactory. Even numerous commercial illuminants designed to give suitable distribution curves fail to do justice to their light-flux and its distribution by violating fundamental physiological requirements.

The physiological problems of illumination—that is, the effects entering between the objective distribution of light-flux in space and the subjective effects that are produced in the human eye—are, therefore, the most important with which the illuminating engineer has to deal. The first feature which must be recognized is that the objective illumination, as measured by the photometer, is no criterion of the subjective illumination—that is, the physiological effect produced by it—with regard to clearness, comfort, and satisfaction; and it is the subjective illumination by which the success of an illuminating engineering problem is judged.

The most important physiological effects are: (1) The contraction of the pupil, (2) fatigue, and (3) differences. The pupil of the eye automatically reacts, by contraction, on high brilliancy at or near the point of the retina on which is focussed the image of the object at which the eye looks, and to a somewhat lesser extent on high brilliancy anywhere else in the field of vision. If, therefore, points or areas of high brilliancy are in the field of vision, especially if near to objects at which the eye looks, the pupil contracts, and thereby reduces the amount of light-flux which enters the eye. Light-sources of high brilliancy should be arranged so that they cannot be seen directly, and the illumination should be accomplished by light reflected from ceilings, &c., or from reflectors attached to the illuminant, or the light-sources should be located where one is not liable to look at them—that is to say, at or near the ceilings.

When exposed to fairly high light-flux density, the nerves of the eye decrease in sensitivity by fatigue; and, inversely, in lower illumination or in darkness they increase in sensitivity. By exposure for a considerable period to the fairly high illumination required when working by artificial light, it appears less bright, and a higher illumination is required than would be sufficient in the absence of fatigue. In a room having a uniform intensity of illumination one is restless and uncomfortable. For satisfactory illumination, it is necessary not only to provide a sufficiently high intensity at the place where needed, but also to keep the intensity as low as permissible wherever it is not needed, so as to afford to the eye rest from fatigue. Of considerable importance regarding fatigue is the colour of the light. Fatigue at high intensities occurs far more with yellow and orange rays than with white light, and very little with green and bluish-green light. Thus, in artificial illumination, in which practically always the yellow and orange rays greatly preponderate, the question of fatigue is far more important than with bluish-white diffused daylight, and the irritating effects of fatigue are therefore mostly felt with artificial illumination.

Objects are seen and distinguished by differences in colour and in intensity of the light reflected by them. If there were no

differences in colour or in intensity in the field of vision, one would see light but would not distinguish objects. In good illumination, the differences in colour and in intensity should, therefore, be sufficiently high to see clearly by, but they should be so limited as not to preponderate to such an extent as to distract the attention from any smaller differences. Differences in colour are, however, under the control of the illuminating engineer to only a limited extent. In some cases, he can control or advise regarding the colour of objects such as the walls, ceilings, &c.; but in most cases the absolute colour of the illuminated objects is not within his control.

The main distinction of objects is due to differences in intensity or brightness. For producing these differences, shadows are of foremost assistance; and, indeed, the differences of intensity, by which objects are seen, are to a large extent those due to shadows. The study of the shadow is therefore one of the most important subjects of illuminating engineering. If there were no shadows, but a perfectly diffused illumination, even if the intensity were sufficient, the illumination would be unsatisfactory, because of the loss of the assistance of the shadows in distinguishing objects. Seeing becomes more difficult; illumination, restless and uncomfortable.

The use of shadows for illumination requires directed light—that is, light coming from one or a number of sources, and not merely diffused illumination coming from all directions. While, however, in general, perfectly diffused illumination is unsatisfactory, an illumination having only directed light is also unsatisfactory. If all the light is directed, as from a single arc lamp, the shadows are absolutely black, and one cannot see anything in them; and in attempting to see the objects in the shadows the illumination becomes tiring to the eyes, irritating, and restless. For satisfactory illumination, it is necessary, therefore, to have sufficient directed light to mark the edge of the objects by their shadow, and thereby improve the distinction; but at the same time there must be sufficient diffused light to see clearly in the shadow—that is to say, a proper proportion of directed and of diffused light is necessary.

The requirements of satisfactory illumination can be grouped in two main classes, referring respectively to economy and to comfort; the characteristics being as follows: (1) General or uniform and local or concentrated illumination, and combination of the two. This is of importance for economy; to avoid the production of unnecessary light-flux; to reduce the effect of fatigue; and to add to the comfort. (2) Diffused and directed illumination, and combinations of the two, and the theory of the shadow. This is of importance for the comfort of illumination, in securing clearest distinction. (3) Quality or colour of light, of importance in economy, to suit the colour to the intensity of illumination, and in comfort by increasing or softening the differences in colour shades. (4) Massed and distributed illumination, as controlling the distribution of the light-flux, and thereby the economy, and also the diffusion. (5) Direct illumination and indirect illumination, shaded, diffracted, diffused or reflected light, in its relation to the brilliancy of the light-source, and thereby the effect of the contraction of the pupil, on economy and comfort.

Some of the common mistakes made in illumination are: (1) Unsatisfactory proportion of general and of concentrated light. (2) Exposure of lamps of high brilliancies in the field of vision, such as naked filaments. (3) Unsuitable proportion of diffused and directed light. (4) Improper direction of directed light and the accompanying improper length of shadows. (5) Sharp edges of shadows.

Some typical cases may be considered in order to show the applications of the preceding principles.

Domestic Lighting.—Domestic lighting usually requires a combination of concentrated illumination of fairly high intensity locally at the work-table, dining-table, &c., and general illumination of low intensity, to secure comfort and economy. Occasionally, as in halls, &c., the local lighting is absent, and only general illumination is required; while in a sick-room the general illumination is absent, and only local illumination is required.

In this illumination, the proportion between directed and diffused light should be such as to give the proper effect of shadows. The problem of domestic illumination is, therefore, to produce a definite distribution of light-flux density with a definite proportion between diffused and directed light. By deviating from the proper proportion on one side, the room appears to be cold and uncomfortable; while by deviating in the other direction, it appears dark and gloomy.

The light issuing directly from a single illuminant is directed light; the light issuing from a number of illuminants is diffused by the overlap of the light-fluxes of the illuminants—the diffusion being greater the greater the number of illuminants. The light reflected from walls and ceilings is diffused light. The proportion between the light reflected from walls and ceilings and the direct light from the illuminants varies with the reflecting power of walls and ceilings—that is, with their brightness or darkness. The proportion between directed and diffused light, therefore, can be changed, and the diffused light can be increased by increasing the number of illuminants, and also by increasing the brightness of walls and ceilings. With a chosen brightness of walls and ceilings, the desired distribution of the light-flux—a local high and general low intensity—can be produced by a single illuminant having the proper distribution curve of light-flux. In this case, however, there is usually obtained too much directed and not enough diffused light. The same distribution of light-flux can be produced by using a large number of illuminants properly located—nearer together for the local than for the general illumination. In the latter case, there is obtained more diffused and less directed light; and by choosing the number of light-sources, it is possible, with a given brightness of walls and ceilings, to get the desired distribution of light-flux and at the same time obtain the proper proportion of directed and diffused light. With a different brightness of walls and ceilings, the distribution curve of a single light-source required to give the desired light-flux distribution is correspondingly changed; and the lighter the walls and ceilings, the more light is reflected to give a diffused general illumination, and less direct light is required from the illuminant for the general illumination. With increasing reflecting power of walls and ceilings, the proportion of diffused light increases, and the number of light-sources required to give the proper proportion between directed and diffused light decreases. In a room with light walls, a smaller number of light-sources is therefore required for good illumination than in a room with dark walls, assuming the same intensity of local and of general illumination.

The problem of domestic illumination, which is to obtain a certain distribution of illumination with a definite proportion between directed and diffused light, therefore leaves one independent variable—the brightness of walls and ceilings. This result is necessary, because the problem of domestic illumination is twofold—namely to get the proper illumination by means of daylight, and also to get it for artificial illumination. During daytime, the windows are the source of light—the directed light issuing from the windows, the diffused light from the walls and ceilings and by the overlap of the light from several windows. The proper distribution between local and general illumination during daytime, and at the same time the proportion of directed and diffused light, therefore determines the number of windows and the brightness of walls and ceilings, in the manner previously discussed.

As the reflecting power of walls and ceilings is fixed by daylight considerations, it can be chosen only to a limited extent by considerations of artificial illumination. As already noted, however, this result is not necessary, for the problem can be solved by using a combination of a suitable number of light-sources of proper distribution curves. To some extent—due to the different qualities of artificial light and daylight—the walls can possess a different reflecting power for the one than for the other. As artificial light is deficient in blue and green, a bluish or greenish shade of walls and ceilings gives them a greater reflecting power for daylight than for artificial light, which is usually desirable. The opposite is true with a reddish-yellow shade.

Street Lighting.—The problem of street illumination is to produce a uniform low intensity. For reasons of economy, the intensity must be low, at least in American cities, in which the length of street per inhabitant is usually many times as great as in European cities. Moreover, the same type of illuminant is usually required for the entire area of the city. The low intensity of illumination necessitates the use of the quality of light which has the highest physiological effect at low densities—that is, white light—and excludes the yellow light as physiologically inefficient for low intensities. An even better effect would be produced by the bluish-green light of the mercury lamp, which, however, is not much liked, due to its colour. The greenish-yellow of the Welsbach mantle is also quite satisfactory for these low intensities. The American practice of preferring the white light of the carbon or magnetite arc lamp is therefore correct and in agreement with the principles of illumination. The yellow flame arc lamp can come into consideration—even if it were not handicapped by the necessity of frequent trimming—only in those specific cases where a high intensity of illumination is used, such as in the centres of some large cities.

Uniformity of illumination is specially important in street lighting, where the observer moves along the street; and the decrease of subjective illumination by fatigue is especially objectionable on account of the low intensity. For a street illuminant there is required a distribution curve which gives a maximum intensity somewhat below the horizontal, no light in the upper hemisphere, and very little downward light. Street-lamps therefore should be judged and compared by the illumination given midway between adjacent lamps, or at the point of minimum intensity—in other words, by the intensity in a direction approximately 10° below the horizontal. This requirement also is in agreement with American practice. It is very important, however, that the downward intensity should be very low; and in this respect it is not always realized that the light thrown downwards is not merely wasted, but is harmful in producing a glaring spot at or near the lamp. The fatigue caused by it reduces the effective illumination at the minimum point between the lamps. In this respect the most objectionable lamp is the open direct-current carbon arc lamp; but even with the enclosed arc lamp, the distribution of light on the street surface is still far from uniform, and the intensity is too high near the lamp.

The greatest defects of the present street lighting which frequently makes it inferior in subjective illumination even to the far lower illumination given by the full moon, are the absence of diffused light, and especially the improper direction and termination of the shadows, and also the high brilliancy of the illuminant. The light of the usual street-lamp is practically all directed light issuing in a nearly horizontal direction from a point source. The shadows are thus far longer than are permissible, and they all

terminate sharply and without blurr. Objects in the shadows are practically invisible; and the end of a shadow looks like the edge of an object, thereby producing a misleading effect which results in unsatisfactory illumination. To give a somewhat better direction to the light requires considerable increase of the height of the lamp above the street surface. This change would also essentially decrease the intensity of illumination below and near the lamp, without appreciably affecting the intensity at the minimum point, and thus would give a more uniform and better illumination.

No valid reason usually exists against considerably increasing the height of the lamps, except that of the greater cheapness of short lamp-posts, which is hardly justifiable. It is more difficult to give a proper blur to the ends of shadows, so as to distinguish them from edges of objects. This would require an increase of the extension of the illuminant, by opal globe, &c. Enclosing the arc by an opal globe, however, will scatter the light more uniformly in all directions, and thereby spoil the distribution curve, and interfere with the required uniformity of illumination. With an opal globe, the intensity in the downward direction does not differ very much from that in the horizontal; while with lamps 20 feet above the street level, and at distances of 200 feet from each other, the downward intensity of uniform illumination should be not much more than 1-25th of that under an angle having a sine of $20 \div 100 = 0{\cdot}2$, or 12° below the horizontal.

The only way of maintaining a proper distribution curve and at the same time diffusing the light so as to reduce its brilliancy and blur the shadows, appears to be to use proper prismatic diffraction, on the principle of the Fresnel lenses of lighthouses. Obviously, where the lamps are close together, as in the centre of large cities, their light-fluxes overlap, and thereby give a better diffusion, and at the same time the midway point between lamps is under a greater angle against the horizontal, and therefore a more downward distribution of the light-flux is permissible. For the largest part of American street lighting, however, this remark does not apply.

In conclusion, I desire merely to emphasize the fact that it is not sufficient to arrange the distribution of light-flux so as to get the proper illumination as measured by the photometer, but that the physiological effects of the light require careful study, because they are essential in determining the effect of the lighting, and very often constitute the difference between a satisfactory and an unsatisfactory illumination.

GASEOUS EXPLOSIONS.

Second Report of the British Association Committee.*

During the session 1908-9, the work of the Committee consisted partly of new investigations and partly of study and critical discussion of English and Continental work already published. The new work has necessitated the design and construction of much new apparatus, and especially of new optical indicators. Four meetings were held in Mr. Dugald Clerk's laboratory in London, and one at the National Physical Laboratory. The five meetings were all excellently attended. Seven notes were presented and discussed:

No. 7.—The Analyses of Exhaust Gases from the Petrol Engine (W. Watson).
No. 8.—Some Experiments on Chemical Equilibrium in Gaseous Explosive Mixtures (Dugald Clerk).
No. 9.—Deville's Experiments on the Dissociation of Gases (J. A. Harker).
No. 10.—On Radiation in a Gaseous Explosion (B. Hopkinson).
No. 11.—The Alternate Compression and Expansion of Dry Air in an Engine Cylinder (Dugald Clerk).
No. 12.—Direct Measurement of the Temperature of the Working Fluid in a Gas-Engine Cylinder (W. E. Dalby).
No. 13.—The Temperatures reached in the Compression of Air (B. Hopkinson).

It will be observed that Notes Nos. 7, 8, and 9, by Professor Watson, Mr. Dugald Clerk, and Dr. Harker, deal with the question of chemical equilibrium; while No. 10, by Professor Hopkinson, though dealing primarily with radiation, also bears upon the same subject. Notes Nos. 11 and 13, by Clerk and Hopkinson, are devoted to the study of the compression and expansion of cold air within a cylinder; while No. 12, by Professor Dalby, deals with the direct determination of the suction temperature in a gas-engine when working.

Professor H. B. Dixon has continued his experiments on the ignition point of gases by two methods. In the first, the gases are heated separately before being brought into contact, and the temperature is determined at which the meeting gases enflame. The combustible gas is led up a narrow tube of glass or quartz in the axis of a larger tube heated electrically; air or oxygen passes up the space between the two tubes. The wider the tubes and the quicker the flow of gases—*i.e.*, the less the contact action of the heated surfaces on the mixing gases—the lower the ignition temperature was found to be. Experiments made between half an atmosphere and two atmospheres showed a lowering of the ignition temperature with an increase of pressure.* In the second method, the mixed gases are fired by sudden compression in a cylinder, according to Nernst's suggestion. Photographs have been taken, on a rapidly moving film, of the flames produced by adiabatic compression. The values found are lower than those given by the first method, as was to be expected from the high pressures at which the gases are fired. These experiments are being continued. Professor Dixon has also continued his experiments on the velocity of sound in different gases heated in a long tube.

Apart from the new investigations dealt with in the notes, much preparatory work has been done by many of the members. Thus Professor Dalby has refitted the engine—the subject of his experiments—with electric ignition, and arranged the end so as to take a new optical indicator; Professor Bone has made preparations to extend his well-known experiments to explosions and combustions where oxygen is present in excess; Professor Coker has improved his apparatus for studying wall-temperature changes; Professor Burstall, in conjunction with Professor Hopkinson, has made comparisons between a good mechanical indicator and the Hopkinson optical indicator; Watson, Callendar, and Dalby have devoted much study to the improvement of the diaphragm optical indicator; and Hopkinson and Clerk have improved the operation of their piston optical indicators.

In this report, the sequence of the first report will be followed as far as possible, so that the effect of the year's work will be readily apparent.

Measurement of Internal Energy or Specific Heat of Gas at High Temperatures.

No new high-temperature experiments on "volumetric heat" have been published; but attention has been devoted to the lower end of the scale, as Regnault's and other standard results were shown last year to be in need of revision. This was necessary in order to clear the ground for high-temperature work.

I.—*Constant Pressure Experiments up to* 100° *C.*

It was stated in the first report that the results of Regnault for the specific heat of air at ordinary temperatures which have hitherto been accepted as correct, were materially lower than those obtained by some more recent observers. Among these latter researches, the most important were perhaps those of Mr. Swann,† the results of whose experiments, which had not then been published, were communicated to the Committee by Professor Callendar, and gave values about 2 per cent. higher than those of Regnault. Mr. Swann's results have now been published, and he has supplied the Committee with a complete copy of his paper. The method employed by him had previously been used by Professor Callendar for determining the specific heat of superheated steam. A current of the gas is passed over an electrical heater, the energy supplied to which can be accurately measured, and the temperature of the gas is measured before and after passing the heater by means of platinum thermometers. The rise of temperature, which amounted to about 5° C., can be measured correctly to 0·001° C.; and an at least equal degree of accuracy is obtainable in the measurement of energy supplied. A correction of the order of 10 per cent. of the total supply of heat has, however, to be applied for the loss of heat from the gas as it passes to the thermometer. It is assumed that with a given inflow and outflow temperature of the gas, this loss of heat is independent of the rate of flow, and its amount is determined by experiments at different rates of flow.

It will be remembered that a correction, amounting to about 5 per cent., was applied in Regnault's experiments for the flow of heat by conduction along the substance of the pipe which connected his heater with his calorimeter. Regnault assumed that, with a given temperature difference, this correction was independent of the rate of flow of gas. It was pointed out by Professor Callendar that this assumption could not be justified, and that it would lead to too low a value of the volumetric heat. The corrections involved in the methods employed by Swann have been fully discussed by the author and also by Callendar. They appear to admit of determination with an order of accuracy approaching 1 in 1000 in the result. On this account, and because of the close agreement of Swann's results with those obtained by Joly, the Committee consider that there is now little doubt that Regnault's figures were too low, and that the volumetric heat of air at 100° C. may be taken as being within 1 per cent. of 5 calories per gramme-molecule, or 19·8 foot-pounds per cubic foot.

They have come to this conclusion with less difficulty because to a great extent they have Regnault's own authority for it. He appears to have been fully aware of the uncertainty introduced into his results by the heat-flow along the connecting-pipe. He discusses it in the same way as Callendar and Swann, and arrives at the same conclusion—that is, that it would be in such a direction as to make his results too low. The passage in his original paper in which he deals with this matter is of very considerable interest, both historically and in connection with the work of the

* See *ante*, p. 633.

* Dixon and Coward: "Ignition Temperature of Gases," "Journal of the Chemical Society," 1909; see also "JOURNAL," *ante*, p. 323.

† "The Specific Heats of Air and Carbon Dioxide at Atmospheric Pressure by the Continuous Electrical Method at 20° C. and 100° C." By W. F. G. Swann, A.R.C.S., B.Sc. Proceedings of the Royal Society, Series A, Vol. LXXXII., 1909.

Committee. [It was reproduced in full in an appendix to the report.]

For the volumetric heat of carbon dioxide, the Committee also feel justified in adopting Swann's values as correct to within 1 per cent. They are as follows:—

	At 20° C.		At 100° C.
Specific heat at constant pressure. . .	0·202	..	0·221
Volumetric heat—			
Calories per gramme-molecule (taken as 44 grammes)	6·930	..	7·760
Foot-pounds per cubic foot	27·400	..	30·700

II.—*Clerk's Experiments.*

In the first report it was pointed out that the values of the volumetric heat of gas-engine mixture obtained by Dugald Clerk by the compression and expansion of gas heated by combustion were (at a temperature of 1000° C.) about 10 per cent. higher than the corresponding values given by Holborn and Henning's experiments at constant pressure. Callendar expressed an opinion that the constant-pressure methods of determining specific heat were subject to systematic errors which would tend to make the results too low. This view has received further confirmation in the publication of Swann's work, to which reference was made in the last section; for Regnault's experiments were of the same character as those of Holborn and Henning, and any error of defect in his values might be expected to be of even greater magnitude in their experiments. On the other hand, Hopkinson gave reasons for supposing that Dugald Clerk's values were too high because of a difficulty in determining the division of heat loss between the compression and expansion lines. In support of this view, Hopkinson stated that he had found that when cold air was compressed and expanded in a gas-engine driven by an electric motor the values of the volumetric heat deduced by Clerk's method from the compression and expansion lines were too high, and that the air took in heat during the first half of the expansion stroke, though its mean temperature was above that of the walls.

This point has been made the subject of detailed experiments by Dugald Clerk, who communicated a preliminary account to the Committee in Note No. 11. His experiments were made on the "R" engine of the Institution of Civil Engineers' tests, † of 9 inches diameter and 17-inch stroke, which was driven by an electric motor. The exhaust valve of the engine was permanently closed during the experiments, and communication was made with a large reservoir containing dry air by means of the charge inlet-valve, which was held partially open until the desired engine speed was attained, when the valve was tripped and acted on by the usual cam, so as to take an air charge into the cylinder. The trip-gear was so arranged that after one full opening and closing the valve was held closed during the experiments, so that the air thus trapped in the cylinder was alternately compressed and expanded. In this respect, Clerk's arrangements differed from Hopkinson's, who kept both inlet and exhaust valves working continuously in the ordinary way; thus taking in a fresh charge of air at every alternate revolution—compressing and expanding it once and then discharging it. An optical indicator was used to take the diagrams, one of which is reproduced in fig. 1. [This diagram belongs to a later set of experiments.]

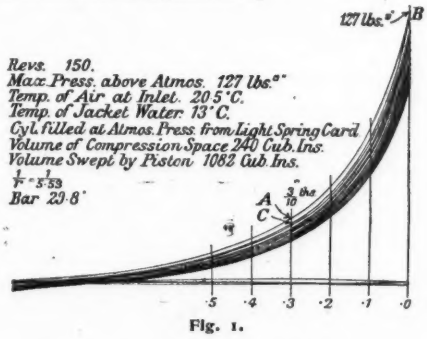


Fig. 1.

An analysis of the last three-tenths of the first compression line and the first three-tenths of the first expansion line (A B and B C on the figure) by Clerk's method, in which the heat loss is treated as the same in compression and expansion, subject to an allowance for the higher temperature in the former, gave as the value of the volumetric heat of air 20·9 foot-pounds per cubic foot, or 5·28 calories per gramme-molecule. This was the mean of six cards, three of which were taken at a speed of 120, and three at 180 revolutions per minute. The maximum value found was 21·1, and the minimum 20·5. The mean temperature on the expansion line was about 170° C., and the value of $\overline{C}$ obtained by extrapolating slightly from Swann's results would be 20·16 at this temperature and at atmospheric pressure. Unless, therefore, the difference in density gives rise to a greater difference in the volumetric heat than seems at all probable, Clerk's value is about 3 per cent. too high.

Clerk then went on to calculate from the diagram the actual heat loss on the compression and on the expansion stroke, assuming the true value of the volumetric heat to be 20. Comparing the heat loss in the last three-tenths of the compression (A B) and the first three-tenths of the expansion (B C), he found that they were in the ratio of about 3 : 1; whereas the mean temperature on compression was only about 11 per cent. greater than over the corresponding range in expansion. He further found that the heat loss from 0·1 to 0·4 on the expansion stroke was practically *nil;* while on the corresponding part of the compression stroke it amounted to about 7 per cent. of the work done on the gas.

Commenting on these results, Clerk says:

The experiments show that the gas does not, on the whole, gain heat during the first half of the expansion stroke, as was found by Hopkinson.* But they do show that for some reason the heat loss is divided very unequally between the compression and expansion strokes. The proportion varies from point to point of the stroke, and also varies largely with the temperature of the walls; but for the inner one-tenth and the first three-tenths of the stroke the compression heat loss appears to be about three times the expansion heat loss. From this it follows that Hopkinson was correct in his expectation that the specific heat of air determined by division of heat loss in proportion to mean temperature would be too high. The experiments show that this method of division leads to a value about 3 per cent. higher than the true value.

Clerk also finds from these experiments that the greater part of the heat loss was incurred at the inner tenth of the stroke during compression and expansion at the higher temperature and density; 80 per cent. of the loss on the three-tenths was due to the inner tenth. The loss on the compression line from 0·4 to 0·1 of the stroke was small, and that on the expansion line was less. Calculating $\overline{C}$ as the mean value on these lines, the value is 20·7 foot-pounds per cubic foot. The mean temperature in this part of the diagram was 120° C.

In view of these experiments on the compression and expansion of cold air, the Committee consider that the division of heat loss in the high-temperature compressions on which Clerk's values of the volumetric heats are based may require some revision, and that these values may on this account be rather too high. The results given by air (as to ratio of heat loss between compression and expansion lines) at temperatures of the order 200° C. may, however, not be quantitatively applicable to gases cooling at the high temperature of 1000° C. It will be necessary to experiment further on high-temperature compression before the amount of the correction necessary on this account can be decided. Clerk has made arrangements to continue the work on these lines, and hopes to be able to carry his explosion experiments to about 3000° C. by a modified method.

Clerk determined the leakage of the piston by two methods, and found that it did not exceed 0·3 per cent. per stroke; so that error by leakage is negligible.

Hopkinson's suggestion that heat may be absorbed by a body of air when the mean temperature is higher than that of the walls enclosing it has been supposed by some to be impossible. If, however, the case be put in the following way, it will be readily admitted that his explanation is quite possible.

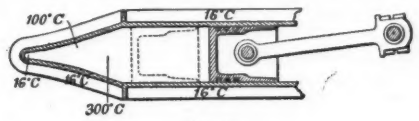


Fig. 2.

Referring to fig. 2, which is a diagrammatic section of a gas-engine cylinder having a very elongated compression space, if it be assumed that air be compressed within the cylinder until the piston is full in, as shown in the dotted position, then the mean temperature may rise to (say) 240° C. as a mean throughout the whole space; but the air at the extreme end of the space may be cooled down nearly to the wall temperature, assumed to be 16° C. The temperature will thus range from nearly 16° C. at the small end of the cone to perhaps 300° C. in the open part of the compression chamber. Such a disposition may be made to produce a mean temperature throughout the whole compression chamber of 240° C. If the air be now expanded by moving the piston from the dotted position to the full-line position, it is obvious that the temperature of the air, which has been reduced to 16° C., by contact with the walls, will fall below that temperature, and so heat may be added to the air at the extreme end, while heat is still being lost to the cylinder by the air near the piston. Many gas-engine constructions have narrow spaces, and the engine "R" above its inlet-valve has such a space, so that the temperature throughout, even during compression and expansion, may be very unequal.

Though unequal division of heat flow between the compression and expansion lines must be accepted as a fact, the Committee are not yet satisfied as to the explanation. The view put forward by Clerk in his original paper,† when discussing the possibility of an error from this source, was that the difference, if any, between the heat flow during expansion and during compression was

† *Vide* Minutes of Proceedings, Vol. CLXIII., p. 288.

* The gain of heat found by Hopkinson may have been due to the fact that he did not trap a single charge, but continually compressed and expanded fresh charges, in consequence of which the temperature of the cylinder walls, and especially of the face of the piston, must have been materially higher than in Clerk's experiments.

† Proc. Roy. Soc., Series A, Vol. LXXVII., 1906.

to be ascribed to a rise in the temperature of the surface of the metal or of a film adhering thereto. He expressed the opinion that any difference so caused could not be great on account of the small possible variation in temperature of the metal surface. Hopkinson's suggestion, on the other hand, was based on the possibility of large variations of temperature in the gas, and he referred the change of heat flow not to the metal surface, whose temperature (he thought) might for this purpose be supposed to be constant, but to changes in the temperature gradient in the layer of gas close to the walls. The controlling influence of the condition of the surface layer on the rate of heat flow from the gas appears in many experiments. In a gaseous explosion in a closed vessel, for example, the flow of heat from the gas to the walls is at first intensely rapid, for the hot flame is brought into immediate contact with the cold wall, and the heat is drawn from the still hot surface layer, and has not very far to travel. As time goes on, however, this layer becomes cooled down, and serves as a jacket resisting the flow of heat from the hotter core within. Study of the curve of cooling after explosion in a closed vessel shows the rate of fall of temperature diminishes in much greater proportion than the temperature itself; and the same thing was shown by Hopkinson's experiments with a recording calorimeter, in which the rate of heat flow was directly measured and found to vary nearly inversely as the square root of the time elapsed.*

The basis of Clerk's method is a comparison of volume and pressure changes in the rapid compression of a gas in a closed cylinder. In adiabatic compression the relation between these two quantities is

$$PV\gamma = \text{a constant},$$

and the mean value of the volumetric heat over the range of compression is $\frac{R}{\gamma - 1}$, where R is the gas constant and equal to 7·75 foot-pounds per cubic foot, or 1·96 calories per gramme molecule. The value of γ for true adiabatic compression is deduced from the actual indicator diagram by making corrections for heat loss in the manner to which reference has already been made. Another method of obtaining γ is to find the relation between corresponding pressure and temperature changes in rapid compression. For adiabatic compression this relation is of the form

$$\theta \propto P^{\frac{\gamma-1}{\gamma}}$$

where θ is the absolute temperature. It has been applied for small ranges of temperature by Lummer and Pringsheim, and also by Makower, who suddenly opened to the atmosphere a large glass globe, containing air at a pressure of a few centimetres of mercury above the atmosphere, and measured the resulting fall of temperature at the centre of the globe by means of a platinum thermometer. He obtained in this way the value 19·3 foot-pounds per cubic foot, or 4·9 calories per gramme molecule, for the volumetric heat of air at 20° C., which is certainly within 2 per cent. of the truth, without making any correction for heat loss from the air at the centre of the globe where the temperature was being measured.

Hopkinson has commenced experiments, described in Note No. 13, with the object of applying a similar method to the compression of air in a gas-engine cylinder. The engine is motored round, taking in a charge of air at every alternate revolution, compressing it, expanding it, and exhausting it in the usual way. A fine platinum wire at the centre of the combustion space of the engine measures the temperature of the air at that point, and simultaneous measurements of the pressure at the beginning and end of compression are also made. A small correction for time-lag in the wire has to be applied. This amounts, at a speed of 250 revolutions per minute, to about 6° C. at the completion of suction, and is negligible at the top of compression. The value of the volumetric heat, calculated from the pressures and temperatures at these two points—on the assumption that the compression was adiabatic, and that γ was constant—is 20·33 foot-pounds per cubic foot; the values in different experiments ranging from 19·76 to 20·95. The true value, according to Swann, for the range of temperature employed (20° to 270° should be 20·1. It would appear, therefore, that the compression at the centre of the combustion space in an engine of this size (the diameter was 7 inches and the stroke 15 inches) is very nearly adiabatic; and there is reason to suppose that the method may yield good results when applied to higher temperatures. The experiments were all made at various speeds, ranging from 60 to 250 revolutions per minute; and the fact that the values obtained at 60 revolutions per minute are not systematically greater than those at higher speeds is further evidence that the loss of heat is small. The method has the advantage that it is independent of leakage.

Hopkinson found that in this engine at the top of compression the temperature of the air at a distance of 0·5 centimetre from the wall was about 30° less than in the centre. At points nearer to the wall—that is, within 1 millimetre—the temperature fell off very rapidly. It was still, however, decidedly above that of the wall at a distance of only 0·1 millimetre. He is continuing his experiments, with a view to giving a complete account of the temperature distribution, and elucidating more completely the phenomena of heat flow. The general result, so far as he has gone, would appear to be that the layer of air in which the temperature gradients are considerable is extremely thin. It may, in fact, be difficult to decide precisely what is the nature of the film which determines the heat flow. Once in solid metal, it is quite certain that the temperature variations are extremely slight, and cannot be such as to materially affect heat flow. On the other hand, the temperature of the air a fraction of a millimetre away from the wall is very much higher than that of the metal, and approximates to the mean temperature of the gas. It is the temperature gradients in the composite layer of matter, partly air and partly solid or oil film, between these points which finally determine the heat flow. It is possible that Clerk, who regards the solid and adherent film as the seat of the temperature changes* and Hopkinson, who ascribes the action to a thin layer of air, are really dealing with the same thing from opposite points to view.

(To be continued.)

* *Ibid.*, Vol. LXXIX., p. 138.

* In later experiments on the compression and expansion of air in "R" engine, with a very large flow of water through the jacket, Clerk finds that the heat flow of compression and expansion becomes nearly proportional to relative temperatures. This appears, in Clerk's view, to support the hypothesis of an adherent film, which in some conditions of experiment accumulates heat and rises in temperature.

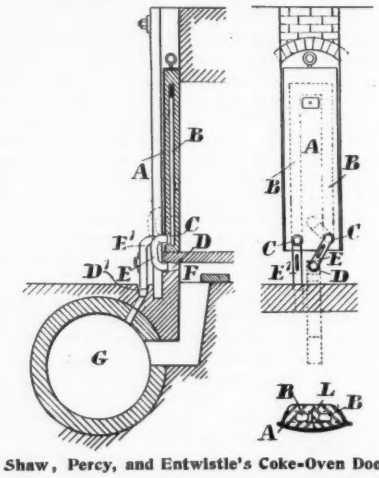
REGISTER OF PATENTS.

Doors for Retorts, Coke-Ovens, and Other Furnaces.

SHAW, F., PERCY, T. McL., and ENTWISTLE, J. K., of Ince, Lancs.

No. 17,647; Aug. 22, 1908.

This invention relates to the heating of the doors of retorts, coke-ovens, and other furnaces to prevent "black ends" or the imperfect coking of portions of the charge, and consists in connecting the interior channels with the flues by removable bridge-pipes, whereby a portion of the waste gases or products of combustion from the heating flues are passed through the door to the chimney.



Shaw, Percy, and Entwistle's Coke-Oven Door.

The illustration shows the application of the invention to a coke-oven. Channels B are built in the lining of the door A and provided at their lower ends with openings or sockets C, which can be connected to similar openings or sockets D D^1 in the sole, main, chimney, or other flue of the retort or oven, by means of a movable bridge or junction pipe or pipes E E^1 when the door is closed. The channel in the door is connected to the sole flue F of the oven by the bridge-pipe E, and to the main chimney flue G by the bridge-pipe E^1; thus forming a sort of by-pass for the hot gases on their way to the chimney. In addition, openings may be made near the top of the door into the channel B, through which a portion of the hot gases in the top of the oven can flow down to the bridge-pipe E^1 at the bottom of the door, and thence to the chimney.

The invention is shown as applied to a liftable door lined with fire-brick blocks L, with passages adapted to form vertical channels B connected at the upper part of the door. Openings or sockets connecting with the channels B are made in the outside of the door, and the bridge-pipes E E^1 connect the channels B with any of the ordinary flues of the oven or retort.

Pipe-Coupling.

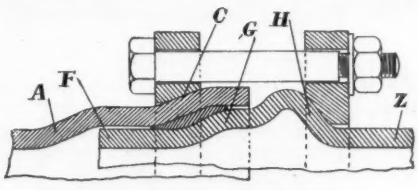
CLARK, W.; a communication from the Dellwik-Fleischer Wasser-Gas Gesellschaft, m.b.H., of Frankfort-on-the-Main.

No. 22,423; Oct. 22, 1908.

This coupling for pipes belongs to the class of sleeve couplings in which an enlargement serving as an abutment for a slipper-on ring is formed at the end of each pipe, so that the pipe ends are forced together by tightening-up the connecting screws with which the two rings are provided. It consists in the special shape of these enlargements, "which shape is of importance, both for ensuring a perfectly tight joint and for readily establishing the connection; the elasticity consequent on this shape rendering expansion pieces unnecessary."

A portion of the pipe A near the end is enlarged to form a cylindrical sleeve, from which extends a divergent conical portion C. The end F

of the other pipe Z maintains its original cylindrical form, and is provided with a conical enlargement G, which corresponds to the enlargement C of the other pipe-end. In rear of the enlargement G there is a



Dellwik-Fleischer Pipe-Coupling.

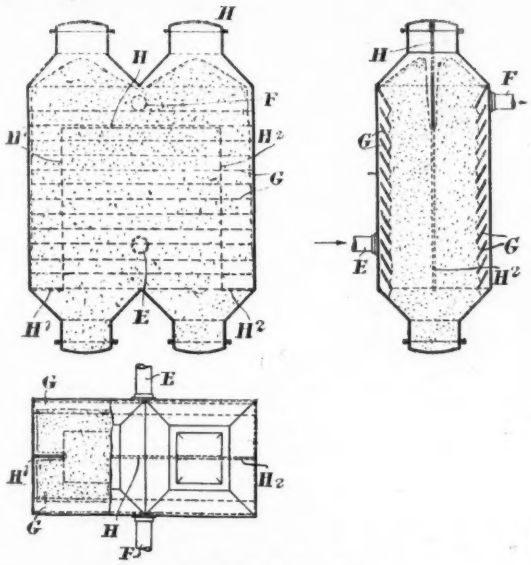
further enlargement H, constituting a spring bead extending around the outer surface of the pipe. Packing material being provided, flanges or rings are placed on to the pipes, and they are drawn together by screw bolts.

Gas Purifying Apparatus.

SCHMIEDT, E., of Aschaffenburg, Germany.

No. 5768; March 10, 1909.

This invention relates to purifying apparatus of the type comprising one or more "towers" (having closed tapering ends) within which louvres are provided where the gas enters and leaves each tower—thus "ensuring the most uniform distribution of the gas possible throughout the purifying mass." The inner walls of the tower are provided, between the louvres at the inlet and outlet of the gas, with approximately vertical baffles, which project into the purifying material in such a manner that they prevent the direct passage of gas from the inlet to the outlet, even if there be free spaces between the walls of the tower and the purifying material.



Schmiedt's Gas-Purifier.

The apparatus illustrated comprises two towers connected together, and each provided at its upper end with a cover for filling or charging, and with a lower cover for emptying or discharging. In the lower part of one side wall is the gas inlet pipe E; while the gas outlet pipe F is connected to the opposite side wall. The two side walls are provided with louvres G, "by means of which the gas is distributed throughout the whole cross sectional area of the tower as it enters and before escaping." Between the two sets of louvres is arranged a vertical partition or baffle plate H, the upper portion of which extends across the two towers and fits closely against the inner walls of their upper part; while the two portions H^1 H^2 extend downwards from the main baffle, and are connected to the transverse walls at right angles thereto. The baffle projects from the top of the tower to below the lowest louvre, and from the transverse walls a short distance into the purifying material, as shown. If the upper covers are arched, they are provided with ribs which, when the covers are closed, fit tightly against the upper edge of the baffle.

If, after the charging of the purifier, fritting or settling of the purifying material takes place during working, no portion of the unpurified gas entering through the pipe E can pass direct to the outlet pipe F through any free spaces formed, but all the impure gas is forced to flow round the baffle H H^1 H^2. The gas has consequently to pass through the purifying material between the baffle and the outlet.

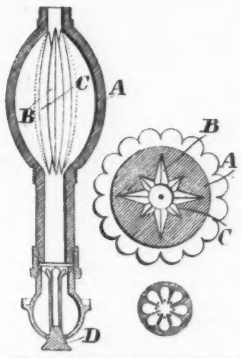
Inverted Incandescent Gas-Burners.

FISK, J. W., of Cardiff.

No. 6588; March 19, 1909.

This invention consists in the formation of a recuperating chamber in the bunsen tube and in a substantially corresponding formation of the nipple, either singly or in combination in an inverted incandescent gas-burner.

The bunsen tube between the air regulator at top and the attachment for the globe gallery, is expanded so as to form a recuperating chamber



Fisk's Inverted Gas-Burner.

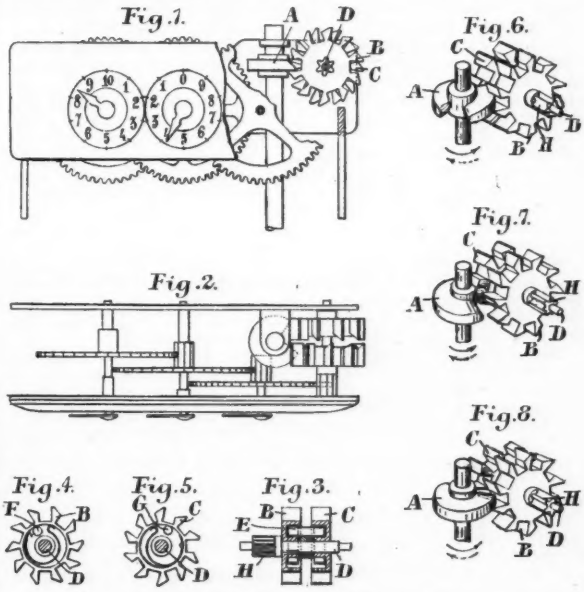
A for the more intimate blending of the gas and air. The chamber tapers in diameter towards each end. The bore of the tube also preferably expands from the ends of the chamber, and is provided with radial longitudinal triangular extensions B, alternating with like, but shallower, extensions C, both series of which taper in sectional area towards the bore at either end of the chamber. At its maximum diameter the bore of the chamber thus substantially presents the form of a star. The nipple attached to the lower part of the bunsen tube is furnished with radial sockets to receive the mantle lugs. It is expanded into globular form; the inner chamber of the nipple presenting a formation like the recuperating chamber. It is subdivided by a series of ribs into a number of radial chambers opening into a common central bore and converging at the bottom towards a convex inward projection of the spreader D. Each chamber is provided at the bottom with a minute hole, so that the mixture of gas and air from the recuperating chamber escapes in a series of radial jets according to the number of radial ribs, or radial chambers.

Recording Mechanism for Meters.

COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ, of Paris.

No. 10,062; April 28, 1909. Date claimed under International Convention, April 29, 1908.

This invention relates to an arrangement whereby the hands of the registering mechanism of a meter are caused to rotate always in the same direction, even if the direction of rotation of the measuring parts —such as the drum or bellows of a gas-meter or piston of a water-meter or equivalent device—were reversed, either owing to an error in the manufacture or intentionally for the purpose of making the registering mechanism reduce the amount recorded.



A French Gas-Meter Fraud Preventer.

When applied to gas-meters with a drum, the device presents as its main advantage that the locking pawl with which such meters are generally provided for the purpose of preventing reverse movement is done away with. This pawl, as the patentees point out, is the cause of serious disadvantages, for sometimes it renders the levelling operation very difficult. Moreover, the consumer can, by exchanging the inlet and the outlet pipes or by blowing from the outlet side, not only make the apparatus count backwards by forcing into the inlet conduit a certain volume of gas or air, but can also expel outwards a portion of the water from the meter until the gas passes directly through the centre of the fly-wheel without being measured. During the time that the water is being forced back, the pawl preventing the drum from rotating in the opposite direction allows the air blown into the meter to

exercise pressure on the surface of the water, the level of which is lowered at the outlet side and raised at the inlet side, so that the water escapes through the overflow pipe arranged on the inlet. If the valve does not close hermetically, the meter admits the gas from the inlet to the outlet directly without measuring, when the level of the water is lowered sufficiently. If, on the contrary, the valve closes tightly, it is sufficient, in order to obtain the same direct passage of non-measured gas, to incline the apparatus so that the water flows forward and raises the valve, though at the same time the back portion is left unprotected and the central opening of the drum is uncovered, and the gas can pass through this opening directly from the inlet to the outlet without any movement of rotation of the drum, and consequently without measuring.

The locking pawl of the measuring device having been done away with according to this invention, any fraudulent attempt made in the conditions indicated will be useless, "for in that case the air or gas blown in will act on the drum to cause it to rotate in the direction opposite to that of its ordinary movement, without producing any change in the level which would enable the water to escape outside." It is pointed out, moreover, that with their device the volume of the air blown in, instead of being subtracted from the volume normally registered, will, on the contrary, be added to it; "so that any fraudulent attempt will be to the disadvantage of the defrauder."

Fig. 1 is a longitudinal elevation of the arrangement, with certain outer parts removed. Fig. 2 is a plan of one construction of mechanism. Fig. 3 is a cross section through the axis of one of the essential parts of the mechanism shown in figs. 1 and 2. Figs. 4 and 5 are cross sections through fig. 3, but in opposite directions. Figs. 6, 7, and 8 are perspective views of the same part as fig. 3 combined with its controlling member—both being shown in different positions.

The vertical spindle on which the measuring part of the meter acts is provided with a slotted disc A, with bevelled radial edges directed towards the lower face of the disc with which, and at each side of the vertical plane of its axis, two toothed wheels B C engage, mounted on the same spindle D. The teeth of these wheels are bevelled on the one hand in the same direction in accordance with one of their radial faces, and, on the other hand, in the opposite direction in accordance with their corresponding adjoining faces perpendicular to the spindle D. The wheel B is secured to the spindle D, while the wheel C is mounted in such a manner that it can rotate on this spindle and be brought into a given position where the teeth of the two wheels do not coincide, under the combined action of two springs arranged respectively in a recess of each of the wheels, and of a common stop E oscillating freely on the spindle D and having the tendency to be maintained by the springs in contact with the pins F G of the wheels. The combination of the slotted disc A and of the spring-controlled wheels B C constitutes a kind of double anchor escapement, working in such conditions that, whatever be the direction of rotation of the disc A, the movement transmitted to the spindle D is always in the same direction—in fact, the wheels B C, owing to the action of their inner springs, have the tendency to remain in such position relatively to each other that their teeth are in staggered order. Thus, during the movement of rotation of the disc A (whatever be the direction of this movement), one of the bevelled edges of the disc always engages with the tooth with which it meets from below, so as to raise it, and consequently rotates the wheel in a given direction to any desired extent, in order to bring it into a position in which its teeth coincide with those of the other wheel—that is to say, into a position which allows the solid portion of the disc A to pass between the corresponding teeth of each of the wheels B C.

Figs. 6, 7, and 8 show clearly the main stages of working of this kind of double escapement. In fig. 6, the disc A maintains, by means of its solid portion, the two wheels B C (shifted relatively to each other) in such a position that their teeth coincide; so that, assuming the direction of the rotation of the spindle to be as shown by the arrow in full lines, the wheel B will advance to the extent corresponding to the distance to which it has moved as soon as the recess will allow this advance, as shown in fig. 7. The disc A continuing to rotate in the same direction, as soon as the edge of the recess passes under the teeth of the wheel B which has just advanced, this tooth is raised to an extent corresponding to the tension of the spring of the wheel C, so that the latter escapes in its turn, in order to advance to the extent of half-a-tooth when the recess passes in front of the tooth of the wheel C which the disc was holding. It therefore follows that to each rotation of the disc A correspond successive advances to the extent of one tooth for each of the wheels B C; and this movement is transmitted by the pinion H of the spindle D to the wheels of the registering mechanism.

The same stages of working are successively reproduced when the disc rotates in the opposite direction—that is to say, in the direction of the dotted arrow, with the difference that it is the wheel C which escapes and which is shifted relatively to the wheel B in order to allow the escapement and the subsequent shifting of the latter.

APPLICATIONS FOR LETTERS PATENT.

20,447.—Fabry, R. F. F., "Recovering the bye-products of coal gas and the like." Sept. 7.

20,486.—Lucas, H., "Gas-burners." Sept. 7.

20,492.—Duchanoy, M., Bousquet, G., and Davicion, M., "Gas-producers." Sept. 7.

20,504.—Simonin, H., "Utilization of the waste of the purification of illuminating gas." Sept. 7.

20,592.—Tully, C. B., "Retort-furnaces." Sept. 8.

20,600.—Lea, J. W., and Perrins, J. H., "Incandescent gas." Sept. 9.

20,625.—Lines, A. A., "Attaching globes." Sept. 9.

20,631.—Riedel, R., "Extracting nitrogen and carbonic acid from combustion gases." Sept. 9.

20,653.—West, J., "Discharging and charging machine for gas-retorts." Sept. 9.

20,658.—Surmont, F., "Acetylene generator." Sept. 9.

20,716.—Shears, F. W., and Lee, G. W., "Incandescent burner." Sept. 10.

20,774.—Woodward, F. G. A., "Eyeleted and wind-proof mantle." Sept. 11.

20,828.—Yates, H. J., "Gas-heated radiators." Sept. 11.

MISCELLANEOUS NEWS.

THE CALCUTTA LIGHTING CONTRACT.

Some Correspondence.

As a further step in the negotiations which have been taking place between the Calcutta Corporation and the Oriental Gas Company with reference to the public lighting of the city, we have had sent to us for publication the following letters, which appeared in the "Statesman" for Aug. 26. These relate to a draft agreement which was generally approved at a meeting of the Special Committee appointed to consider and report on all matters between the Corporation and the Gas, Tramways, Telephone, and Electric Light Companies.

On July 30, the following letter was written on behalf of the Oriental Gas Company to the Chairman of the Corporation.

No. 1.—I now have the honour to enclose signed draft contract drawn up in consultation and in agreement with Mr. Mansfield in accordance with the cable received from the Corporation of Calcutta on the 16th of June last. The Directors recognize that the present condition of mains and services in Calcutta is not such as to ensure compliance with the terms of the new contract; and with a view to being in a position to carry out the conditions as to pressure, they have already spent considerable sums in the provision of new mains, and have sanctioned the further heavy expenditure necessary to execute the proposed arrangements in a satisfactory manner. They also undertake that, as soon as possible after ratification of the new contract, this work shall be completed under the direct supervision of a capable, experienced, and responsible distribution engineer, who will be in charge of a special Mains Department, and whose services shall be retained (or replaced as may from time to time be necessary) during the whole period of the contract. It will be the duty of this Mains Department at all times during that period to maintain all main and service-pipes and the brass cocks on the public lamps in the highest possible state of efficiency and repair. With regard to the Company's works, it is probably within the knowledge of the Corporation that very considerable extensions and improvements have been effected by the Company during the past few years; and I am directed to convey to you the Board's assurance of their intention at all times to take such steps as may be requisite to ensure that the Company shall be in a position fully to meet any demands that may arise for the supply of gas for both public and private lighting.

No. 2.—During the discussion of the draft agreement for the public lighting of Calcutta with Mr. Mansfield, the Directors wished, as usual, to insert a clause exempting them from the payment of municipal rates, as they feel they have a strong claim to such exemption, which has been allowed for the past 50 years. Mr. Mansfield, however, informed them that he was aware a resolution had been passed on this subject, and he had no instructions to discuss the matter. He knew there was a strong feeling in Calcutta in favour of a suitable pressure being maintained during the daytime. He thought, if the Directors would agree to guarantee a minimum pressure during the daytime, you would be prepared to reconsider the matter and to continue the exemption of the Gas Company from payment of rates. The Directors therefore suggest the insertion of a clause in the new contract as follows: "The said Corporation shall pay or bear all municipal rates and taxes which have been, or hereafter during the continuance of this agreement shall be, made, assessed, or levied by the said Corporation upon the said Company for any premises occupied by them in Calcutta, whether in use, occupation, or otherwise; and in consideration of this concession, the said Company agree to maintain a minimum pressure of gas during the daytime which shall never be less than one inch."

Then follows a letter addressed by Mr. Alfred Mansfield to the Chairman of the Corporation, dated July 30.

I beg to report that I have completed the negotiations, on your behalf, with the Directors of the Oriental Gas Company, Limited, in London, for the public lighting of Calcutta. I am sending by this mail a printed draft of the proposed agreement, signed by the Oriental Gas Company and myself, for your consideration and approval. I beg to draw your special attention to the following points.

The Corporation undertake the supply of all lamp-posts, brackets, lanterns, burners, and mantles, and the lighting and extinguishing of all public lights. This leaves the Corporation free to make any arrangements they choose with regard to these important items.

The Gas Company will be paid for gas only at a fixed rate per 1000 cubic feet; and we have definitely arranged the method of measuring the gas, which I think you will find is satisfactory.

The Gas Company will supply coal gas only; and if they wish to dilute or enrich this gas, they must first obtain the consent of the Corporation in writing. This is a very important clause.

The Gas Company supply all pipes, including the cock at the top of each lamp-post. In the past, I understand, the Corporation have supplied the piping from the bottom of the lamp-post, including the brass cock. A number of the existing brass cocks are defective, and of bad design. It will be necessary to replace these. The Gas Company will supply and fix all piping and brass cocks, at their own expense, to all new lamps. An awkward position would then be created, unless the Gas Company become the owners of the small quantity of piping and the brass cocks which exist, as the owner is naturally responsible for maintenance. I have therefore arranged, subject to your approval, that all this piping inside lamp-posts and the brass cocks, paid for by the Corporation, become the property of the Gas Company in exchange for their undertaking to maintain them in a satisfactory condition, and supply any new brass cocks which are required, of a pattern approved by the Corporation, at the expense of the Gas Company. I trust this will meet with your approval.

With regard to the price of gas, my endeavours to select a number of towns in England whose example could be followed with advantage to the Corporation were not successful. I plainly saw that the insertion of such a clause would lead to endless arbitration or litigation.

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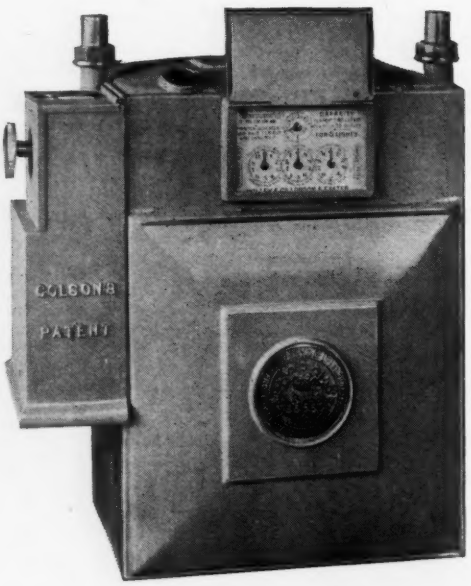

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English towns are by no means perfect in their gas supplies. I therefore suggested, and the Directors agreed, that it would be better to fix a definite price up to a minimum pressure of 4 inches. For a time we were in serious disagreement. The Directors insisted that their price of Rs. 2-8 per 1000 cubic feet was for 2 inches pressure only. The views on both sides were so strong on this point that I was afraid we would not be able to agree. I am glad, however, to say that we came to terms, as shown in the draft of the agreement. I have no hesitation in advising you to accept these terms, as the price is reasonable, and you will be able to take advantage of increased pressure, or not, at your pleasure, after the first five years of the agreement, without arbitration or reference of any kind.

The testing clauses are explicit; and in order to make them absolutely complete, I have introduced into the agreement all instructions and particulars which are necessary, so that no question can at any time arise as to the method of conducting tests. The instruments to be used, the standard of light, and all other points are in conformity with the best practice in England, adapted to the climate of Calcutta. The penalties are such as to ensure the rigid observance of all the clauses in the agreement.

The Directors wished to insert a clause exempting them from Municipal rates; but I pointed out that this was entirely outside my province. I am aware that a resolution had been passed declining to admit any exemption from rates in the new contract, although this has been enjoyed for the past fifty years. My only regret is that I have not been able to insist on a day pressure. I am officially advised by you that the Gas Company have special powers from Government, and the Corporation have no control over day pressure. I beg to suggest that gas during the daytime is a necessity; and the ratepayers in such an important town as Calcutta have some claim on the Corporation to see that they are supplied with gas at a proper pressure. I informed the Directors that, while I had no authority to discuss this matter with them, I would be prepared to suggest that the question of exemption from Municipal rates be reconsidered on condition that they agreed to maintain a day pressure, which would enable private consumers to use modern appliances for heating and cooking, or gas-engines for industrial purposes, during the daytime. They are willing to consider this, and have addressed a letter to you on this subject. I trust this matter will receive your favourable consideration, as I feel the arrangements will not be complete without some provision being made for the private consumer.

I expressed a desire that the Directors should forward to you a letter indicating their recognition of the fact that considerable improvements were necessary, and the manner in which they propose to carry them out. They have sent me a draft of a letter which they are sending to you, which is in accordance with my wishes.

I trust the terms we have arranged will be confirmed. Every detail has been so fully argued from both sides, and the Directors of the Oriental Gas Company have met me on so many points, that I am convinced it will be useless to suggest any amendments unless the whole question is again re-opened.

To the correspondence, is appended the following note by the Chief Engineer:

I have read through the agreement very carefully. In my opinion it is a masterpiece, and is probably the most perfect agreement existing for the supply of gas to any large city. I therefore trust that the Committee and the Corporation will allow the agreement to remain as it stands, as I am strongly of opinion that any changes would probably turn out for the worse. With reference to the proposal that the gas-works should be exempted from rates as in the past, I have only to remark that this is entirely a matter for the Commissioners to decide; but I would suggest that if the proposal is considered at all, exemption should not be granted for any less day pressure than 15-10ths. This latter pressure is sufficient for working gas-engines, water-heaters, cookers, &c. In conclusion, I have only to state that I am of opinion that Mr. Alfred Mansfield has been much more successful in these negotiations than I expected.

BRISBANE (QUEENSLAND) GAS COMPANY.

A Presentation to the Chairman after Thirty Years' Service.

The Half-Yearly General Meeting of the Brisbane Gas Company was held on Friday, Aug. 6—the Hon. JAMES COWLISHAW, M.L.C., presiding—when the report and accounts were presented. Some particulars as to the results of the working were given last week, p. 707. The report was adopted, on the motion of the Chairman, seconded by Mr. T. Budd. A vote of thanks was also extended to the officers of the Company.

When the business of the meeting had concluded, the Deputy-Chairman (Mr. James Clark) took the chair. He announced that he had received a number of apologies from shareholders who were unable to be present, but who joined with those at the meeting in extending their congratulations to their Chairman, and welcomed the idea of making him a presentation, which would show, in a slight measure, their appreciation of the work which he had done. Mr. Clark reviewed briefly the progress of the Company's business since Mr. Cowlishaw became Chairman in 1879; and he showed that the progress made not only had kept pace with the progress of the city, but that the interests of shareholders and citizens alike had been safeguarded. The opportunities for investment in the Company's business now were regarded as the best on the market.

Mr. D. J. Abercrombie supported the remarks of the Deputy-Chairman, and said he yielded to none in the high esteem which he had of the ability of Mr. Cowlishaw. It was with extreme pleasure that, on behalf of the shareholders, he wished to express his high esteem, his admiration, and his appreciation of their Chairman's work.

Mr. L. M. Bond also expressed the opinion that the shareholders owed a deep debt of gratitude to Mr. Cowlishaw for the work he had performed.

Mr. G. Phillips said that the details given by the Deputy-Chairman in his brief review of the Company's position, showed that the interests of the citizens of Brisbane had not been neglected. The frequent reductions in the price of gas showed that the Chairman had studied not only the interests of the Company, but also the interests of the citizens.

Mr. Clark then handed to Mr. Cowlishaw a service of plate, and in doing so, he said it afforded him the greatest pleasure to present to Mr. Cowlishaw such a handsome gift, and he hoped he would long be spared to direct the affairs of the Brisbane Gas Company.

[The service of plate consisted of a tea and coffee service, on a silver tray, an afternoon tea set to match, two epergnes, and a soup tureen.]

Mr. Cowlishaw, responding to the toast of his health, thanked the Deputy-Chairman and other speakers for their kind remarks concerning him, and the shareholders generally for the confidence which they had reposed in him. The Deputy-Chairman, he said, had given those present some idea of the progress which had been made by the Company, and standing there that day and surveying the difficulties which they had overcome, and the triumphs which they had won, he could not fail to be impressed, not only with the success of recent years, but by the careful manner in which the Company's interests had been safeguarded by Directors and Officers in the years of its infancy, so to speak. At a meeting held on Feb. 23, 1864, presided over by Mr. Shepherd Smith, the Manager of the New South Wales Bank, it was decided to establish a Gas Company. As soon as professional services were required, Mr. Robert Fleming, uncle of Alderman P. Fleming, of the City Council, was appointed Engineer. Of all the shareholders of that year, only three were shareholders and living now. He (Mr. Cowlishaw) for some years acted as Auditor to the Company; and in the year 1879 he was appointed Chairman, which position he still held, after an interval of thirty years. Some of the speakers, he said, too generously had mentioned that his individual efforts had been responsible for the progress which had been made. He was proud that his efforts, small though they were, had met with the commendation of the shareholders; but he wished to say that the success which had followed his years of office had been made possible only by the loyal and devoted services of the officers and staff.

The service of silver plate referred to is, it is said, regarded by competent judges as the best collection which has ever been imported into Queensland. It bore the following inscription: "Presented to the Hon. James Cowlishaw, M.L.C., by the shareholders of the Brisbane Gas Company, as an expression of their esteem, as well as an appreciation of his zeal and untiring service during the past thirty years as Chairman of the Company, 6th August, 1909."

GAS SUPPLY IN DUNEDIN.

The Work of a Distribution Department.

In the course of his fourth annual report to the Dunedin City Council (dated April last), dealing with the more important matters that have from time to time engaged the attention of the Council during the past year, Mr. R. W. Richards, the Town Clerk and City Engineer, makes the following remarks upon the work of a distribution department, in connection with the Municipal gas undertaking. It will be noted that the question of distribution was specially referred to during the proceedings at the opening of the Dunedin Gas-Works extensions which are reported in another part of this issue.

Now that the gas-works extensions have been completed, and that the Council have the Caversham Gas-Works in their undertaking, it is perhaps fitting to again submit the advisability of the Council controlling and directing the distribution of the gas to the consumers' burners—bearing in mind that when a city corporation are the makers and the vendors of a commodity which is of almost universal necessity to the community the corporation represent, there is a duty, if not a moral obligation, cast upon the municipal body to ensure that such commodity is not only delivered to the customers of good quality and in sufficient quantity to meet their demands, but also that they shall have every facility and information for its use to the best effect for the lowest possible cost. Of late years, a great evolution to this effect has taken place in the attitude of gas authorities and companies towards their customers. In the case of corporation gas undertakings, no doubt this is due to some extent to the electrical propositions that compete; but they, as well as the gas companies, have also been influenced by the commercial axiom that to obtain and keep customers it is not enough to sell them goods—they must be shown how to use them, and that to the best advantage.

Hence there has arisen in all thoroughly up-to-date gas undertakings a department that takes charge of the gas after it leaves the mains and services, and has passed through the consumer's meter. This department, which may be called the distribution department, gives to the consumer of gas the benefit of its technical knowledge to ensure that he obtains the best possible results from the gas purchased.

When gas first came into use as an illuminant, and when gas lighting was so crude in its methods that no skill beyond that of fitting the necessary supply-pipes was necessary to instal it, the business of gas-fitting was, naturally enough, taken over by the already-existing trade of plumbing; and as far as that trade is concerned, practically no advance has been made in gas-fitting to this day. Some authorities writing on the subject make bold to assert that "notwithstanding the delicate apparatus that the modern gas-lighting burner really is, with its careful proportion and adjustment of gas and air to obtain perfect and economical results, not one plumber in twenty has any real knowledge of the construction of a bunsen flame, to say nothing of an appreciation of the requirements for lighting special buildings and areas with regard to their particular needs." It was therefore necessary that a new and specialized form of gas-fitting should arise; and as the only persons possessing any interest in gas-fittings and appliances after they are sold, apart from the consumer himself, are obviously the gas authorities, they are stepping, and have stepped, into the breach, with results equally satisfactory to customers and themselves.

The question next arises, What are the duties and scope of such a

department? Its first duty—the mains department having delivered gas to the premises—is to ensure that a meter of sufficient size is supplied, and that the pipes fitted to the premises are sufficiently large to supply the gas where needed. They should be prepared, where required, to supply and fix the necessary pipes; and in no case should any other person be permitted to fix pipes before the gas reaches the meter. Further, they should be prepared to supply fittings and burners of the latest and most carefully selected description, advising the consumer as to the best position and grouping of lights to suit his special needs. This is particularly important, as in some cases many lights of small candle power are the best, while in others single units of high intensity are more suitable.

But even when the gas is delivered, fittings of the latest, most artistic, and most scientific description supplied, and the whole installation is—what it easily can, and certainly should, be—a monument to the fact that gas is still the cheapest and best of all illuminants, the benevolent supervision of the distribution department should not cease. An arrangement should be made with the consumer by which, for a payment which little more than covers expenses, periodical visits shall be paid to the premises, new mantles fixed where needed, globes and chimneys cleaned, burners re-adjusted, and, in fact, the whole system kept in the condition it was left in when installed. A writer on the subject has stated: "It is positively painful to one who has been trained in this system to pass through the streets of some towns and see the evidences of neglect in the form of carbonized burners and dirty chimneys and globes, obscuring anything from 40 to 70 per cent. of the light that is being paid for."

Of course, in the working of such a department as is here outlined, the great factor is the man in whose charge it is placed. Too much emphasis cannot be placed on this fact, as it is worse than useless for a gas undertaking to attempt to attain the perfection laid down unless they obtain or possess a distributing superintendent who is able to carry out thoroughly the promises which the existence of such a department implies. It should be remembered that this man is the actual point of contact between the gas undertaking and its consumers; so that, taking for granted his technical knowledge and ability, he should also be a man of pleasing personality and of consummate tact, for with the exception of those little differences of opinion as to the amount of gas bills, which will occur in the best regulated gas offices, all consumers' complaints and disagreements will have to be adjusted by him.

The superintendent should have, as his lieutenant, a thoroughly skilled gas-fitter, one whom the superintendent may trust in the early stages of the department to carry out accurately and intelligently his instructions, and thus save him the necessity of constantly re-visiting premises to note progress, and who should be destined, as the department develops, to become the foreman of the gas-fitters, who will, as necessity arises, be engaged. These two, with a clerk (who might act also as storekeeper), should be sufficient to start the department on a proper basis; and further needs will suggest themselves naturally with increased business.

With regard to the charges made for work done by the Council, there are three possible theories:—

(1) Do not enter into cutting competition with the local tradespeople. Charge such a price as to compare with their present charges.

(2) Charge a fair profit, so that the only tradespeople injured will be those who charge exorbitantly.

(3) Charge your customer net cost, allowing only sufficient profit to pay such charges as office expenses, salaries, interest on capital, and so on. Such a profit would, of course, vary with the turn-over, and if no loss even at first was looked for, should probably be about 20 per cent., which might be reduced as the business increased.

There is no doubt in my mind that the last is the correct course to adopt. I am aware that an outcry arises usually from the local plumbers; but I entirely fail to see where they have a grievance. Probably under the second course of treatment they have the greatest right to complain, as here the gas authorities are actually making a profit by their competition. But the gas authorities' position in adopting the third course seems to me to be unassailable. Summed up, the position is this: That the customers of the gas authorities, in consideration of the profit they provide from the gas they consume, have a claim upon those authorities to the extent that any saving that may be effected or any improvement that may be obtained in the purchase of appliances for the consumption of that gas should be given them; and this claim should be paramount over the demand of a trade interest to be allowed to make another profit out of these consumers.

Mr. Charles Eyers, a lighting expert of the United Kingdom, with whom I have conferred on this subject, on the occasion of my last visit to Sydney, and to whom I am indebted for the views that are mainly expressed herein, says: "It is in fact the doctrine of the subordination of the advantage of a section to the public interest. I had an example of this trade objection to the progressive tactics of a gas undertaking in England, when a deputation of the local Ironmongers' Association waited upon the Gas Company with which I was associated, and petitioned them to refrain from competition by selling gas-fittings. Yet most of the members of the deputation were, while anxious to keep up the price of gas apparatus, actually aiding competition with the Gas Company by selling and fitting electric light apparatus. In this connection, it is well to notice that practically everywhere when local authorities have undertaken electric lighting, they have also undertaken, so far as I know, without any serious opposition, the whole installation from dynamo to lamp if required by customers; and in many cases I have heard this policy set forth as the main reason for using electric light instead of gas—the consumer arguing the convenience of immediate appeal in case of breakdown or defect to a skilled and competent authority, instead of to a tradesman of problematic knowledge, who, in the end, might have to fall back on the gas company to locate the fault, and thus cause considerable and vexatious delay."

In previous reports to the Gas Committee, I have dealt with this subject; but it is necessary to include these remarks in this, as the foregoing succinctly sets forth a system that might well be instituted, it being in consonance with the writings of Mr. Robert English, our Consulting Gas Engineer, as well as of Mr. John Hungerford, who is the Resident Engineer.

In conclusion, I am convinced that a well-worked distribution department, with an efficient head, is invariably the source of a much more cordial feeling between producers and consumers, a much more intelligent appreciation of the methods and regulations of a gas undertaking, a greatly enhanced confidence in gas as a lighting, heating, and cooking agent, and finally that *desideratum* a very greatly increased consumption of gas.

The following are a few facts and figures relating to the year's operations, as compared with the preceding year:—

	1907-8.		1908-9.
*Number of consumers	6,049	..	5,962
*Sales of gas	127,299,200 c. ft.	..	145,942,300 c. ft.
*Representing gross cash	£49,483	..	£51,297
*Gas made	141,042,788 c. ft.	..	159,577,187 c. ft.
Coal carbonized	11,121 tons	..	11,571 tons
Average make per ton	12,392 c. ft.	..	12,142 c. ft.
Gas unaccounted for	4·9 per cent.	..	2·8 per cent.
Services laid	271	..	306
Loan expenditure to March 31, 1909	..	..	£52,131

* About 250 special meters were removed owing to a reduction in the price of gas. The price was reduced from 5s. 10d. net per 1000 cubic feet to 5s. in November, 1908.

BRADFORD GAS ACCOUNTS.

A Deficit.

At the Monthly Meeting of the Bradford City Council last Tuesday—the Lord Mayor (Mr. James Hill) presiding—the results of the past year's working of the various undertakings of the Corporation were placed before the members.

Mr. David Wade, the Chairman of the Finance and General Purposes Committee, in making his annual statement, said that, speaking generally, the year's work, so far as the volume of business was concerned, had not been marked by any violent fluctuation; and apart from the storm which occurred in the Wharfedale district last year, costing in repairs some £5000, and a diminished income from gas and residuals of £8000, the net result was practically up to the previous year's level. The aggregate income of the trading concerns was £903,465, and the working expenditure £564,139; leaving a trade profit of £339,326. The charges for interest and sinking fund amounted to £317,907, leaving a net income of £21,419, as compared with a net income the previous year of £36,428. As regarded the water-works, the income was £178,904, and the working and management expenses, including the cost of repairs necessitated by the flood at Barden, amounted to £42,748; leaving a trade profit of £136,156. Against this there was charged for interest and sinking fund £127,580, which left a net profit of £8576. This balance had been carried to the credit of the deficiency account, which at the beginning of the year stood at £10,753, thereby reducing it to £2177. Had it not been for the storm in Wharfedale, there would have been a few thousand pounds to the credit of the reserve fund. The total income on the gas-works account was £291,254, and the working and management expenses £236,914; giving a trade profit of £54,340. The charge for interest and sinking fund was £59,646, making a net loss of £5306. The previous year there was a net profit in this department of £3071. By comparison, therefore, the year's working was worse than the previous year by £8377. He did not wish to create imaginary fears; but a difference of £8000 between last year and the year previous should make them pause. Last year, in speaking of the slender prospect there was under present conditions of meeting expenditure during the year, he said that both tar and coke would yield less by a good many thousands than in the previous year; and this, with other considerations, such as a possibly decreased consumption of gas, pointed to the importance of devising some means of obtaining additional revenue—otherwise at the end of the year a loss instead of a profit would have to be declared. He also said he had a shrewd suspicion that the gas-works, with their present charge of only 2s. 1d. per 1000 cubic feet, would during the current year barely make ends meet. This forecast had been verified; and he thought it called for a revival of the question which had on several occasions been taken up, but never seriously dealt with—namely, the price at which gas should be sold. What security had the Council that the bye-products would realize more next year than this year? The gas undertaking should not be obliged to rely upon bye-products in order to make ends meet. He did not suggest an extravagant price per 1000 cubic feet. Enormous profits were not required; but gas should be sold at a price which would enable the department at least to pay its way, without being at the mercy of the market for residuals. Direct taxation was an admirable and worthy principle; but it could be abused and overstrained, and so far as it obtained with regard to the price of gas, he suggested that last year's figures indicated that the principle had been over-weighted and pressed to breaking strain. They had actually sold at below cost price. If the incentive to municipal trading was the piling up of vast sums as profits wherewith to relieve the rates, he had no sympathy with it. Such a policy was likely to engender prodigality in other directions; but surely the happy medium might be found. If an object-lesson on this point were needed, it was ready to hand in the action of Parliament this session in the case of the Salford and Oldham Bills. Big profits for the relief of the rates were the order of the day; but Lord Donoughmore's Committee limited the appropriation of profit in relief of the rates to 1 per cent. on the outstanding capital. Invested capital was undoubtedly meant, though the word "outstanding" was used. He believed Salford had withdrawn their Bill in consequence of this limitation to 1 per cent.—having been accustomed, like many other towns, to appropriate a good deal more. Years ago Bradford ceased to charge high prices with the specific object of profit-making to relieve poundage rates; but in their eagerness to demonstrate the justice of a principle, they had been unconsciously carried towards the other extreme. The decision of Lord Donoughmore's Committee was one with which the majority of the members of the Council would be in agreement. If

applied to Bradford, it would mean that, with an invested capital in the gas-works of £1,163,735, prices should be so adjusted that, instead of a loss of £5000, there would remain a margin of £11,000 for the steadying of poundage rates or other contingencies. An increase of 2d. per 1000 cubic feet should be tried, making the price 2s. 3d., less 2d. discount. The charge was at one time 3s. 6d. The question would have to be dealt with; and, personally, he would not hesitate to move a resolution. One per cent. upon invested capital was a margin for purposes of adjustment and contingencies which could not be regarded as extravagant; and he saw no reason why it should not be made to apply to every trading undertaking in the Corporation. Ratepayers were the shareholders in these concerns; and to them would revert any surplus over and above the amount required to level-up deficiencies or to relieve rates under special circumstances.

Mr. JOHN LUND pointed out that, while there had been an increase in the consumption of gas in the outer districts of the city, there had been a marked decrease in the centre. The deficit of £5000 on this department, he said, was probably due to bad trade and the competition of electricity. But when he looked at the Electricity Committee's receipts and expenditure, he was surprised to find a surplus of only £2147, against £9700 in 1904 and £8709 in 1905. He suggested that the control of the Gas and Electricity Departments should be placed in the hands of one Committee; for thereby the competition between the two and their capital expenditure might be regulated.

Mr. HORACE GELDARD (the Chairman of the Gas Committee) said that his department had suffered through the increase in the price of coal. Since the undertaking was municipalized, it had produced nearly £500,000 for the relief of the rates; and the very first year it showed a deficit, the Council's "Chancellor of the Exchequer" was crying out for an increase in the price paid by consumers. The Gas Committee were paid £26,000 a year for street lighting; and the addition of 2000 lamps had not been followed by an increased payment. Street lighting cost the Gas Committee nearly £31,000 a year at present; and the deficit would have almost been wiped out if the Gas Committee had been fully paid for street lighting. The great burden that the gas undertaking had to bear was due to the interest and sinking fund charges in respect of the purchase of the gas-works in the outlying districts of the city. He could not understand the suggestion of Mr. Wade that the Gas Department should be made to pay without having to rely on residuals, when residuals alone realized between £60,000 and £70,000. He admitted that electricity was a great competitor of gas, but said he was confident that next year the gas-works would be made to show a profit.

The Finance Bill and Land for Water-Works.—In Parliament last Tuesday, Mr. Samuel Roberts asked whether land acquired by local authorities for water-works purposes or for protecting their area from pollution will be exempted from the provisions of the land clauses in the Finance Bill. In reply, Mr. Hobhouse said Clause 24 (1) of the Finance Bill provides that no duty under Part I. shall be charged in respect of any land or interest in land held by a local or rating authority.

BURY CORPORATION GAS UNDERTAKING.

In the course of their report on the Bury Corporation accounts for the year ending March 31, the Auditors (Messrs. Merchant and Son), referring to the gas undertaking, make the following remarks.

The price of gas for the past year has been 2s. net per 1000 cubic feet, as compared with 1s. 11d. net for the previous year. The profit for the past year has been £18,520. The reserve fund, after adding the bank interest for the past year, stood at March 31 at £5032. As the statutory limit is £5000, the excess of £32 has been transferred to the revenue account, making together £18,552. Out of this has been provided interest and dividends on loans and stocks, £6466; sinking fund, £6313; and reserve fund, £52, leaving a net profit of £5721, one moiety of which—namely, £2860—has been transferred to the general rate, and the remaining moiety has been credited to the consumers in reduction of the price of gas for the current year.

The capital outlay upon works at March 31, 1908, was £304,189. The further outlay during last year comprised: Buildings, £568; plant and machinery, £3382; mains, £1354; stoves, £646; and railway siding, £815 10s. 7d. Thus the total outlay to March 31 was £310,954. The stock of materials, including meters and fittings, is valued at £15,890; the amount owing by sundry persons for gas and meter rents and residuals is £17,319; and the investments with other corporations amount to £14,300. The total assets are therefore £358,463. The liabilities are: Loans on mortgage and redeemable stock, £177,006; creditors, £13,648; and bankers, £14,269. There were therefore at March 31 last surplus assets of £153,540. This surplus has been effected by setting aside out of revenue to sinking funds for the purpose of paying off loans and redeeming stock the sum of £148,540; and the reserve fund of £5000.

NEW PLANT AT TIVERTON GAS-WORKS.

The new plant which has been installed at the Tiverton Gas-Works was formally inaugurated last Friday. The Mayor (Mr. H Mudford) and the members of the Corporation attended at the works, and the improvements which have been effected were pointed out to them by Mr. Clark Jeffrey, the Gas Manager. In large measure, the works have been reconstructed. New retorts have been erected on the regenerative principle, and a new gasholder, washer-scrubber, purifiers and boiler, and engine installed, while a new meter-house and governor-house have been built and the yard extended. As some of the visitors remarked, a complete transformation has been made in the works during the last few years—all tending to greater economy and efficiency in working. The manufacture and erection of the plant have well been carried out by Messrs. Willey and Co., of Exeter, to the designs and under the superintendence of Mr. Clark Jeffrey. In the new washer-scrubber and purifier, there is now ample space for dealing with the

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 745.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 16	10	Alliance & Dublin 10 p.c.	17⅞—18¼	..	5 9 7
298,955	10	,,	7	Do. 7 p.c.	12⅞—13¼	..	5 5 8
310,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96—98	..	4 0 0
200,000	5	May 27	6⅛	Bombay, Ltd.	5⅞—6	+⅛	5 8 4
40,000	5	,,	6⅛	Do. New, £4 paid	4⅛—4⅜	..	5 9 6
50,000	10	Aug. 26	15	Bourne- mouth Gas and Water Pref. 6 p.c.	28—28½	..	5 5 3
311,810	10	,,	7		16⅛—17⅝	..	4 3 7
75,000	10	,,	6		15⅜—15⅝	..	3 16 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	252—255	+1	4 18 0
300,000	,,	,,	5⅜	Do. New	190—192	..	4 19 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 11	4	Do. 4 p.c. Deb.	100—102	..	3 18 5
220,000	Stk	Sep. 10	11	Brighton & Hove Orig.	208—213*	..	5 3 3
246,320	,,	,,	8	Do. A Ord. Stk.	150—152*	..	5 5 3
467,000	20	Apl. 16	10	British	43—43½	..	4 11 11
109,000	Stk.	Aug. 26	6	Bromley, A 5 p.c.	117—119	..	5 0 10
165,700	,,	,,	4⅜	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5⅜	Do. C 5 p.c.	106—108	..	5 1 10
54,000	,,	June 25	3½	Do. 3½ p.c. Deb.	88—90	..	3 17 9
500,000	10	May 13	7	Buenos Ayres (New) Ltd.	13⅜—14⅜	..	4 18 3
250,000	Stk.	June 25	4	Do. 4 p.c. Deb.	95—97	+1	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	4½—5	..	
100,000	10	—	—	Do. 4½ p.c. Pref.	5½—6	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	48½—49½	..	6 1 3
100,000	Stk.	June 25	4½	Do. 4½ p.c. Deb. Stk.	82 84	..	5 7 2
157 150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	106½—108½	..	4 12 2
1,491,280	Stk.	Aug 26	5⅛	Commercial 4 p.c. Stk.	103—110	..	4 14 7
560,000	,,	,,	5	Do. 3½ p.c. do.	104—105	+1	4 14 4
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	5	Continental Union, Ltd.	95—97	..	5 3 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	138—140	..	5 0 0
491,270	Stk.	—	5	Derby Con. Stk.	121—123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
145,995	,,	Mar. 31	5	East Hull 5 p.c. Ord.	100—102	..	4 18 0
486,090	10	July 14	12	European, Ltd.	24½—25	..	4 16 0
354,060	10	,,	12	Do. £7 10s. paid.	18½—19	..	4 14 9
15,141,545	Stk.	Aug. 12	4⅜	Gas light and Coke	4 p.c. Ord.	105⅛—106½	+1	4 7 7
2,630,000	,,	,,	3½		3½ p.c. max.	88—90	+1	3 17 9
3,799,735	,,		4		4 p.c. Con. Pref.	103—105	..	3 16 2
4,193,975	,,	June 11	3		3 p.c. Con. Deb.	86—87	..	3 8 11
258,740	Stk.	Sep. 10	5	Hastings & St. L. 3½ p.c.		92—94*	+1	5 6 4
82,500	,,	,,	6½	Do. do. 5 p.c.		117—119*	+1	5 9 3
70,000	10	Apl 29	11	Hongkong & China, Ltd.		17⅞—18⅞	..	6 0 7
131,070	Stk.	Sep. 10	6½	Ilford A and C		138—140*	..	4 12 10
65,780	,,	,,	5	Do. B		105—107	+1	4 13 6
65,500	,,	June 25	4	Do. 4 p.c. Deb.		102—104	..	3 16 11
4,940,000	Stk.	May 13	8	Imperial Continental		179—181	..	4 8 5
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.		95—97	..	3 12 11

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
195,242	Stk.	Aug. 26	6	Lea Bridge Ord. 5 p.c.	119—121	+1	4 19 2
561,000	Stk.	,,	10	Liverpool United A	223 225	..	4 8 11
718,100	,,	,,	7	Do. B	165—167	..	4 3 10
306 083	,,	June 25	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 11	6	Malta & Mediterranean.	4⅛—5⅛	..	5 17 1
560,000	100	Apl. 1	5	Met of 5 p.c. Deb.	102—105	..	4 5 2
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	102 —104	..	4 0 7
541,920	20	May 27	3⅜	Monte Video. Ltd.	2⅝—13⅛	..	5 5 8
1,775,892	Stk.	July 29	4½	Newc'tle & G't-sh'd Con	10,—108	+½	4 3 4
518,795	Stk.	June 25	3⅜	Do. 3½ p.c. Deb.	92—93	..	3 12 2
55,940	10	Aug. 26	7	North Middl. sex 7 p.c.	13—13⅜	..	5 3 8
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	139—141	..	5 13 6
60,000	5	Sep. 10	8	Ottoman, Ltd.	6—6⅛*	+⅛	6 7 9
30,800	53	Aug. 26	13	Portsea Island A.	137—139	..	4 19 0
60,000	50	,,	13	Do. B.	129—131	..	4 19 3
100,000	50	,,	12	Do. C.	120—123	..	4 17 7
114,800	50	,,	10	Do. D and E.	101—103	..	4 17 1
398,490	5	May 13	7	Primitiva Ord.	7—7⅛	..	4 16 8
796,980	5	July 29	5	Do. 5 p.c Pref.	5⅛—5⅜	..	4 10 11
483,900	100	June 1	4	Do. 4 p.c. Deb.	91—96	..	4 3 4
1,000,000	10	Apl 29	8	River Plate Ord.	16⅞—17⅛	..	4 12 9
312,650	Stk	June 25	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Mar. 31	8	San Paulo, Ltd.	14⅜—14⅝	..	5 8 6
62,500	10	,,	6	Do. 6 p.c. Pref.	12—12½	..	4 16 0
125,020	50	July 1	5	Do. 5 p.c. Deb.	49½—50½	..	4 19 0
135,000	Stk.	Sep. 0	10	Sheffield A	229—231*	+3	4 6 7
269,984	,,	,,	10	Do. B	229—231*	+3	4 6 7
523,500	,,	,,	10	Do. C	229—231*	+3	4 6 7
70,000	10	June 11	10	South African	13⅛—14	..	7 2 10
6,429,895	Stk.	Aug. 12	5⅜	South Met., 4 p.c. Ord.	119—121	..	4 8 1
1,895,445	July	1	3	Do. 3 p.c. Deb.	85—86	..	3 9 9
209,820	Stk.	Aug. 26	8	South Shields Con. Stk.	153—155	..	5 3 3
605,000	Stk.	Aug. 12	5⅜	S'th Suburb'n Ord. 5 p.c.	118—120	..	4 11 8
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	102—124	..	4 0 8
502,310	Stk.	May 13	5	Southampton Ord.	111—113	+1	4 8 6
120,000	Stk.	Aug. 12	6⅝	Tottenham and 3½ p.c.	A 5 p.c. B		133—135	+1	5 1 9
453,940	,,	,,	5⅝			111—113	+1	4 15 3
149,470	,,	June 25	4	Edmonton 4 p.c. Deb.		100—102	..	3 18 5
182,380	10	June 11	8	Tuscan, Ltd.		9—9⅜	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.		99—101	..	4 19 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.		109—111	..	4 10 1
255,636	Stk.	Aug. 26	6⅝	Wands- worth A 5 p.c. B 3⅜ p.c. Deb. Stk.		138— 40	..	4 14 8
79,416	,,	June 25	3			73—75	..	4 0 0
895,872	,,	Aug. 12	5⅜	West Ham 5 p.c. Ord.		124—126	..	4 5 4
210,000	,,	,,	5	Do. 5 p.c. Pref.		127—129	..	3 17 6
253,300	,,	June 25	4	Do. 4 p.c. Deb Stk.		112—114	..	3 11 2

Prices marked * are "Ex div."

present maximum make of gas with a margin for future increase. The gasholder has a capacity of 110,000 cubic feet. By the removal of some old buildings, and the erection of the meter-house and governor-house in a new position, the general appearance of the works is much improved; and more space is afforded for dealing with the coal supplies and stacking coke. A steam-engine and boiler have been installed for the generation of power; but the gas-engine hitherto used is retained as a stand-by.

The Mayor inaugurated the works by beginning the charging of one of the new retorts, for which purpose he was handed by the Manager's son a new shovel, the handle of which was wrapped with coloured ribbons. Several members of the Council followed, and added a few shovels full of coal to the charge.

After this ceremony and the completion of the inspection, the Mayor and Mayoress entertained the Council and visitors to tea, which was laid in the meter-house. Alderman J. Thorne, the Chairman of the Lighting Committee, expressed pleasure at the presence of Mr. Depree, the Chairman of Messrs. Willey and Co., and paid a high tribute to the firm for the effective way in which they had carried out the work. Mr. Depree acknowledged the references to himself and his firm, and remarked that the plans and specifications prepared by Mr. Clark Jeffrey were very clear and had been admirable to work to. Alderman Thorne afterwards proposed a vote of thanks to the Mayor, and said that since the gas-works were purchased by the Corporation in 1895, great progress had been made. Including the purchase money, the total outlay up to March 31 last had been £32,000. They had a sinking fund of over £14,000, and a reserve fund of £3000; so that they had practically paid off over £17,000, and in about six years would have paid off the original capital debt. If they had been a private Company, they could have paid a dividend of about 9 per cent. After the debt was extinguished, gas would be very much cheaper; and there would be something to go towards the expenses of the town. They were largely indebted to Mr. Clark Jeffrey for the excellent results achieved. Mr. Deering, who was first to suggest the purchase of the gas undertaking by the Council, seconded the vote of thanks; and the Mayor, in acknowledging it, complimented Tiverton on having one of the most up-to-date gas-works in the West of England. The services of the Gas Manager were also formally acknowledged.

East-End of London in Darkness.—We learn from the "Daily Mail" that some excitement was caused in the East-End of London late last Wednesday night, when the whole of the electric light in Stepney and Whitechapel suddenly failed; the districts being plunged in total darkness, except for a few street flares and shop lamps. After about three minutes, the light again appeared. At the Pavilion Theatre, Shoreditch, a sun gas-burner in the dome of the auditorium was the only illuminant for some minutes; and there was considerable excitement among the audience. The failure was due to a "slight mishap" at the Borough Council electric generating station at Stepney.

LABOUR AGITATION IN LEEDS.

On Sunday afternoon, the Leeds District of the National Union of Gas Workers and General Labourers celebrated their twentieth anniversary; a crowded meeting being held in the Queen's Theatre.

The chair was occupied by Mr. W. H. Leach, the President of the Trades Council, who reviewed the progress of the Union from the inauguration, and said that now they had 250 branches in Great Britain and Ireland, with 40,000 members, comprising seventy different sections of workpeople. They had four members of Parliament in their ranks. No other Union had been called upon to deal with so many strikes and lock-outs; the reason being that their members worked with members of so many other Trades Unions. He was glad to say, however, that they had weathered the disputes better than most other Unions. During the past two years, they had dealt with 859 legal cases; and they had recovered £20,827 in actions for compensation and wages. Since the Compensation Act came into force, a total sum of £78,219 had been secured for their members; while since the establishment of the Union, they had paid no less a sum than £127,388 for strike, lock-out, and victim pay.

Mr. J. E. Smith said that in Leeds the Union were face to face with a position which was becoming absolutely intolerable. They had not had a single strike in their district during the last twelve years; but this was due rather to the combination they had secured among their workers than to the attitude of the employers. He believed strongly in conciliation; but they must have it from both sides of the table. They had reached a state of affairs in connection with the Municipality under which the members of the Union would not allow them to continue. The word had gone forth from Alderman Wilson to the Consultative Committee that no advances were to be given to any of the men applying. They did not believe in lavish expenditure; but they did not want economy always at the lower-paid workers. This was what was being done by the Leeds Corporation. He would go further, and say that if it had not been for combination the position of the Leeds municipal workers, bad as they were, would have been fifty times worse. They were there to say that, if they had to fight, the old fighting spirit of 1890 could assert itself again. Recently the Water Committee were convinced by a deputation from the Union that certain concessions were just, and they decided to grant them; but Alderman Wilson put his foot down, and said the concessions should not be granted. The Leeds Corporation to-day were harder taskmasters than private employers, when the Corporation ought to be a model. For two years they had been striving to obtain a maximum of 6d. per hour in the Sanitary Department; but it was stated that youths were now being set on to do work hitherto done by men, at a considerable decrease in wages. Further, there was an attempt in all the departments to throw the old men on to the industrial scrap-heap. If their Union stood for anything, it was to protect those who were not able individually to help themselves. The strike was the last weapon that ought to be used; but

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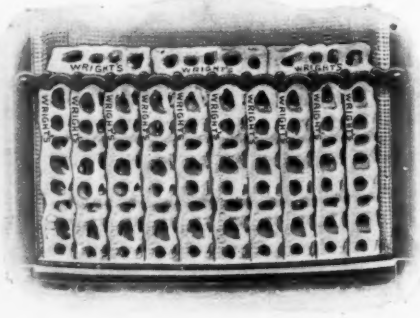

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if they were forced into the corner, he would neither ask for, nor was he prepared to give, quarter.

Mr. Will Thorne, M.P., said that if they wanted to minimize unemployment, a reduction of hours would have to take place in all parts of the country. The rapid transformation in methods of production, and the utilization of labour-saving devices, had made it possible to supply the demands of trade much quicker than before. He hoped that demonstrations would be organized in all industrial centres with the object of bringing about this reduction of hours. Alluding to the Leeds trouble, he asked why they should blame Alderman Wilson. Who returned Alderman Wilson? They had had enough striking. They wanted to strike a little harder at the ballot-boxes.

Mr. Pete Curran, M.P., said that if the Leeds Corporation insisted on a quarrel, at the final stroke they would prove that they were more powerful and more capable of fighting to-day than they were in 1890. They were completely solvent; and they were fearless of any corporation or private employer. They were prepared to discuss questions amicably; but if deaf ears were constantly turned to reasonable appeals, there would be nothing left for them but to use the last weapon at their disposal.

SALFORD'S WITHDRAWN BILL.

Action of Authorities Affected by Gas Clauses.

Representatives from the Local Authorities in the area of the Salford Corporation gas supply held a conference in Manchester last Tuesday to consider—first, what steps should be taken to secure the benefits of the clauses inserted by the Lords Committee in the Bill recently promoted by the Salford Town Council for a reduction in the illuminating power and for sanction to borrow further capital for the undertaking; and, secondly, the following resolution passed by the Salford Town Council on the 1st inst.: "That the Council be recommended to authorize the Gas Committee to enter into negotiations with the out-districts with regard to the supply of gas; and, in the event of a reasonable understanding not being attainable, to intimate that the Council will seek relief from the obligation to supply."

It will be remembered that, following the Lords Committee's decision, the Corporation decided to drop the Bill; it being held that the acceptance of the clauses inserted by Lord Donoughmore's Committee would mean that the Corporation's power to make a profit out of the gas undertaking would practically be taken away.

The proceedings at the conference last Tuesday were private; but it has transpired that two resolutions were unanimously passed, as follows: "(1) That the Town Clerk of Eccles, the Clerk of the Swinton District Council, the Clerk to the Worsley District Council, and the Clerk to the Barton Rural Sanitary Authority should take Counsel's opinion on the question of enforcing upon Salford the concessions granted to the out-districts by the Lords Committee;" and "(2) that any negotiations with the Salford Gas Committee must be with the whole of the authorities at one time."

A Ratepayer's Criticism.

Addressing a meeting held at The Height last Wednesday, Mr. A. E. Jennings, a ratepayer, entered upon a criticism of the Salford Gas Committee's management of the undertaking. Incidentally, he made a comparison between municipal gas undertakings and private gas companies. He pointed out that, while the price of gas at Nottingham and Bolton, for example, was 2s. 6d. per 1000 cubic feet, in Bristol, Newcastle, and Sheffield (with private undertakings) the charges were respectively 2s., 1s. 9d., and 1s. 4½d.

TAUNTON ELECTRIC LIGHT UNDERTAKING.

At the Monthly Meeting of the Taunton Town Council last Tuesday—the Mayor (Alderman J. G. Price) presiding—the Electricity Committee reported that they had considered the letter recently received from the Taunton Chamber of Commerce, and the report which accompanied it, questioning the financial soundness of the undertaking as shown by the published annual statement of accounts, and asking for certain information "in order to dispel the existing feelings of uneasiness and lack of confidence." The Committee did not recognize that there were any feelings of uneasiness and lack of confidence on behalf of the ratepayers generally; and they proposed to inform the Chamber of Commerce that the undertaking was carried on to the satisfaction of the Local Government Board, and the accounts were kept in conformity with the Board of Trade regulations and the Electric Light Orders Confirmation (No. 4) Act, 1893. If, therefore, the Chamber of Commerce desired to go further into the matter, they had better apply to the Local Government Board for an expression of their opinion.

Dr. Macdonald, the Chairman of the Electricity Committee, in moving the adoption of the report, said the Committee felt that no advantage would be gained by publicly discussing this matter at the Town Council meeting, inasmuch as they carried on the electric light undertaking exactly in accordance with the requirements of the Local Government Board. The Committee therefore felt that they were doing the best they could for the town; and the only suggestion they could make was, as stated, for the Chamber of Commerce to apply to the Local Government Board if they required further information. The Committee would help them in every possible way in obtaining it.

Councillor Standfast thought this was rather a curt way of replying to the Chamber of Commerce, as they all knew what sort of Local Government Board they had at the present time. The speaker characterized the Board of Trade as a "brimstone and treacle" body.

There being no further criticism, the report of the Committee was adopted.

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THERE SHOULD BE

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(2) No combustion products inside the loops.

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EXMOUTH WATER SUPPLY.

Another Bill to be Promoted.

It is again proposed by the Exmouth District Council to seek parliamentary powers for works of water supply. Last year, a majority of the ratepayers voted against a similar proposal; but since that time it has been proved that an abundant supply of water is to be obtained from the borehole at Dotton which was sunk at the suggestion of Mr. G. H. Hill, the Engineer, and Professor Boyd Dawkins, whose advice was sought by the Council. In view of this practical demonstration of the accuracy of the experts' forecast, it is anticipated that the ratepayers will now be found in favour of the scheme, in spite of its not inconsiderable cost.

Mr. Hill and Professor Dawkins attended a meeting of the Council last Tuesday, for the purpose of answering questions put by opponents of the scheme. Mr. Hill, in reply to some of the queries, said the surface of the water in the well was about 32 feet above the level of the sea, and there was not the least indication in the analysis of contamination by sea water. During the experimental pumping, they obtained nearly a million gallons a day for a fortnight, which was more than three times the quantity they expected. Every possible scheme for the supply of the town had been considered; and this was the only feasible one. Professor Dawkins said he should like to amplify the last remark. There was no alternative scheme possible in this case, because there was no other site which at all equalled the one at Dotton. They had there a very large supply of good water, which did not interfere with any existing supplies of other places. Mr. Hill added that the scheme was cheaper than an impounding reservoir or any other method would be. Reservoirs were extremely uncertain things; and the contingencies were vastly in excess of anything in connection with a pumping scheme. Mr. Daw, the Chairman of the Water Committee, pointed out that the question of the shortness of water had been under consideration for three years; and to-day they were in no better position than at the beginning, so far as the actual supply was concerned. Those who opposed the present scheme put forward no alternative; while to go on as they were, was to court disaster.

On a vote being taken, it was decided by eleven to five that the necessary steps be taken for the promotion of a Bill in the next session of Parliament to carry out the scheme.

Charge to Prepayment Consumers at Mansfield.—There was some discussion in the Mansfield Town Council with reference to a recommendation of the Gas Committee that, as from the 1st prox., the price of gas for lighting purposes should be reduced from 2s. 8d., 2s. 6d., and 2s. 4d. per 1000 cubic feet to 2s. 6d., 2s. 4d., and 2s. 2d. One member expressed the opinion that the prepayment-meter users were entitled to further consideration; and on his proposition, the matter was referred back to the Committee.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

When a copy of the annual accounts of the Edinburgh and Leith Gas Commissioners was submitted to the Town Council of Edinburgh on Tuesday of this week, Mr. Bruce Lindsay called attention to the extreme difference between the charges made by the Gas Commissioners for gas supplied by prepayment and ordinary meters. In Dundee, he said, the extra charge for gas supplied through prepayment meters was 5·4d. per 1000 cubic feet; in Glasgow, 7d.; while in Edinburgh, it was 1s. 2d. He maintained that the arguments upon which the difference in price was based were fallacious, and suggested that the Gas Commissioners did not desire to encourage the consumption of gas through prepayment meters. The Corporation should impress upon their representatives in the Gas Commission to pay particular attention to the matter, so that the poorer classes should not be penalized. Lord Provost Gibson assured Mr. Lindsay that the Gas Commissioners had always sought to encourage the use of prepayment meters. The reason for the higher charge was not as stated by Mr. Lindsay, but because of the loss sustained in the working of the meters, which was considerable. Several members of the Council, who are also members of the Gas Commission, explained that the subject was before the Gas Commission, and referred to the report upon it which was presented to the Commissioners in July last (see *ante*, p. 195), in which Mr. Herring, the Engineer, gave his opinion that the extra charge of 1s. 2d. was justified. The price of gas was being considered at the present moment. Mr. Lindsay expressed himself as satisfied if the Commissioners had had the matter before them.

On behalf of the Cleaning and Lighting Committee, it was explained to the Musselburgh Town Council on Tuesday that offers by the local Electric and Gas Companies for the lighting of the main thoroughfares of the town had been considered, and that the Committee recommended the acceptance of the offer of the Gas Company, which was £95 less than the other. They had no fault to find with the present lighting by electricity; but the question was whether it was worth about £100 a year more than gas lighting. Electric lighting, it may be stated, was adopted five years ago. Provost Simpson opposed the recommendation of the Committee, and declared that to revert to gas lighting would be a retrograde step. The question of whether shareholders in the Gas Company would be entitled to vote on the matter was raised; and the Town Clerk, who is also Secretary to the Company, ruled that they could not. An equal number voted on each side; and Provost Simpson gave his casting vote in favour of electricity, which will accordingly continue to be used in public lighting.

In the Hamilton Town Council on Tuesday, ex-Provost Keith, in moving the adoption of the estimates and rates for the year, said that while the special surplus which they had received from the Gas Department—£3000—in itself admitted of over 3d. reduction, the municipal assessments were gradually going up. The special credit from the Gas

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BLAND introduced the FIRST REGULATING NIPPLE for Inverted Burners.

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Department had come in at a very hard time, so far as the ratepayers were concerned, and had enabled them to make a small reduction. Bailie Smellie moved that the assessments be reconsidered. He thought that while they had gone a good length in applying £3000 from the gas profits in relief of rates, they might do better, and grant (say) another £1000 or £1500. Bailie Cassells seconded. He considered that the money lying in their hands was the property of the ratepayers, and it ought to have been divided long ago. On a division, the amendment was carried by a majority of one, and the assessments were sent back to the Committee for reconsideration.

In the Arbroath Town Council on Monday, the estimates for the current year were approved. The income is put at £16,011, and the expenditure at £15,852; leaving a profit balance of £159.

The Alyth Town Council on Monday evening were in a querulous mood over the subject of coal gas getting into the water-pipes. The question was introduced by a letter from a resident who complained of "the quantity of gas in the water-pipes" in his house at Airlie Mount. Ex-Provost Tod explained that when the water was shut off the gas, if there were any escape near by, got into the pipes at the hydrants; and Airlie Mount being one of the highest points in the town, the gas was bound to be worse there than lower down. Councillor Lowrie maintained that the same trouble existed at the Market Square, which was certainly not a high point. Bailie Sandilands said that ever since he went to Alyth he had had the same thing to complain of when the water was shut off. He moved that the Gas Company be asked to put their pipes in proper repair. Councillor Robertson considered that it was an impossibility for coal gas to enter a water-pipe at a hydrant. He asked them not to let such a ridiculous and absurd statement go out to the public. The Council eventually adopted the resolution to bring the matter under the notice of the Directors of the Gas Company.

In the Broughty Ferry Town Council on Monday, the Gas Manager —Mr. G. Keillor—reported with reference to the scheme of valuation of the gas-works adopted by the Assessor this year. He said depreciation would not be allowed under any circumstances in respect of gas and water undertakings. Only allowances on *bonâ fide* renewals as and when effected would be conceded. The scheme was most inequitable, and, while not affecting the Electric and Tramway Departments, would seriously affect the Gas Department. He suggested that gas undertakings should be assessed in accordance with the various Revenue Acts, and not a departmental order, as the new memorandum by the Assessor seemed to be. The Council resolved in accordance with the opinion of Mr. Keillor.

During the year to May 15 last, Mr. S. W. Lawson, the Gas-Meter Inspector to the Corporation of Perth, tested 344 gas-meters, of which 324 were found to be correct, and 20 were rejected as incorrect.

In the Newport (Fife) Town Council, on the 6th inst., Bailie Young, the Convener of the Gas Committee, moved that the price of gas for the year be fixed at 3s. 9d. per 1000 cubic feet, being a reduction of 1d.; that meter and stove rents be abolished; and that £250 be added to the reserve fund. He paid a tribute to the splendid services of the Gas Manager—Mr. John F. Black—and to the co-operation which he himself, as Convener, had received from the Town Council. Provost Robertson, in seconding, said the abolition of meter-rents was equal to a reduction of 3d. per 1000 feet. The motion was adopted.

The public lamps in the village of Crossgates were lighted for the first time on Thursday evening and, it is stated, gave great satisfaction. The gas is supplied by the Cowdenbeath Gas Company. The lamps are controlled by Messrs. Alder and Mackay's patented device, by means of which the whole of the lights are turned up in a few seconds. The Gas Company have opened a depôt in the main street, where they make a brilliant display of lighting.

The office of the Dundee Corporation Gas Department is being transferred from Commercial Street to Irvine's Square. A new edifice has been erected there to accommodate the commercial headquarters, and also the meter, piping, and lighting departments of the undertaking. The new premises were inspected yesterday by a Sub-Committee of the Gas Committee.

A special meeting of the Town Council of Aberdeen was held on Wednesday to deal with a recommendation by the Water Committee to apply to Parliament next session for power to take a supply for the city from the River Avon. The report of the Water Committee, dated June 8 last, embodied the findings in a report to them by Sir Alex. R. Binnie and Mr. G. F. Deacon, who, during their investigations, were assisted by Dr. John Horne, F.R.S., of the Geological Survey of Scotland, and Dr. Hugh R. Mill, F.R.S.E., President of the Royal Meteorological Society. These experts recommended the formation of a reservoir in the valley of the Avon as the best permanent solution of the water problem. Their estimate of the cost was, for a first instalment of 10 million gallons a day, £1,068,000; and for a second instalment of 10 million gallons, £443,500—a total for 20 million gallons a day of £1,512,000. Lord Provost Wilson, in moving adoption of the report of the Committee, said that the present water supply was totally inadequate. The city was entitled, under present parliamentary powers, to draw only 8 million gallons a day from the River Dee. The storage capacity was barely two days' supply; and the carrying capacity of the aqueduct was 8 million gallons. Last year, in the month of June, on five occasions, the consumption rose to 8,195,000 gallons. The population of Aberdeen might be fairly stated at 175,000, and, allowing for an increase of 2500 per annum, the city, ten years hence, would have a population of 200,000, whose daily consumption would be considerably over 8 million gallons. The time had now arrived for making provision for a larger supply to meet the growing demands of the city. There was another and very cogent reason for steps being taken—and that speedily —to deal with the water supply, which was the condition of the aqueduct. This was designed to carry 6 million gallons per day. It was intended that it should be constructed of double brick, but, to save money, it was made of single brick, and was made to carry 8 million gallons a day instead of 6 millions. The water as at present delivered to the citizens was unfiltered, just as drawn from the river, except in so far as the heavier impurities had sunk to the bottom of the reservoir, or been

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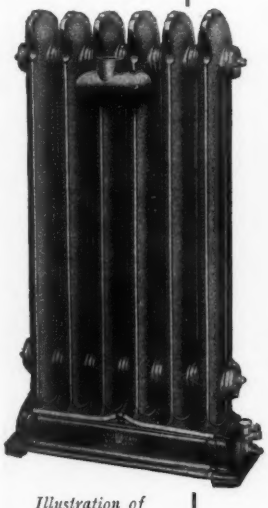

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intercepted by screens. The water in the Avon was unpolluted, and would not require to be filtered, by which there would be an annual saving of £1825. It was moved, as an amendment, that before application be made for statutory powers, a plebiscite of the ratepayers be taken. It was argued, in support of it, that the present water supply could be augmented; that the existing pollution could be removed at small cost; and that the new scheme would impose a burden on the community which they would be unable to bear, and would discourage industry. In the course of the long discussion, it was mentioned that it was anticipated that a domestic water-rate of 1s. in the pound would be sufficient to meet the cost; but the opponents of the proposed scheme were confident that it would be necessary to impose a rate even as high as 1s. 7d. The Council adopted the scheme by 19 votes to 13.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 18.

Sulphate of Ammonia.

Although there has been continued good demand, supplies seem to have been more plentiful, and there has been no further appreciable improvement in values. The closing prices are £11 7s. 6d. per ton f.o.b. Hull, £11 8s. 9d. per ton f.o.b. Liverpool, and £11 10s. per ton f.o.b. Leith. There is still inquiry for delivery ahead; but buyers will not follow the advance, and no important business has transpired. For delivery up to the end of the year, £11 12s. 6d. f.o.b. best ports is quoted; and for delivery over spring months, £11 15s. per ton is asked.

Nitrate of Soda.

The market is quiet, and prices remain 9s. 6d. per cwt. for 95 per cent., and 9s. 9d. for refined quality.

LONDON, *Sept.* 20.

Tar Products.

The markets for tar products have been steady throughout the past week, with the exception of creosote, which is rather dull. Pitch has been in good demand, and makers are holding for high prices; and some quantity is reported to have been sold on the east coast for prompt delivery at 29s. 3d. Creosote is quiet. There are not many orders just now, and in the North especially low figures are spoken of. Benzol, 90 per cent., is firm in London, where makers appear to be well sold. In the North they are willing to take 5¾d. per gallon, casks included, for delivery over the next three to six months; and even at this figure business is difficult. Benzol, 50 to 90 per cent., is firm; and the demand for toluol is good, especially in the North. Solvent naphtha is steady and in very good demand in London; and actual London makes appear to be decidedly short. Heavy naphtha is quiet, and there does not seem to be very much business doing. Carbolic acid is depressed; and Continental manufacturers decline to advance their limit owing to the poor demand for crystals.

The average values during the week were: Tar, 15s. 3d. to 19s. 3d. *ex* works. Pitch, London, 30s.; east coast, 29s. 3d. to 29s. 9d.; west coast, 28s. 6d. to 29s. 6d. f.a.s. Benzol, 90 per cent., casks included, London, 6¼d. to 6⅜d.; North, 5⅝d. to 6d.; 50-90 per cent., casks included, London, 7¼d.; North, 6⅝d. Toluol, casks included, London, 9d.; North, 8½d. Crude naphtha, in bulk, London, 3½d. to 3⅝d.; North, 3¼d. to 3½d.; solvent naphtha, casks included, London, 11d. to 11½d.; North, 10d. to 10½d.; heavy naphtha, casks included, London, 10½d. to 10⅝d.; North, 9½d. to 9⅝d. Creosote, in bulk, London, 2⅝d. to 2¾d.; North, 2¼d. to 2⅜d. Heavy oils, in bulk, 2⅜d. to 2½d. Carbolic acid, 60 per cent., casks included, east coast, 10½d. to 10⅝d.; west coast, 10¼d. to 10½d. Naphthalene, £4 10s. to £8 10s.; salts, 37s. 6d. to 40s., packages included and f.o.b. Anthracene, "A" quality, 1⅜d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been firm during the past week. The principal Gas Companies now quote £11 10s. to £11 11s. 3d. upon Beckton terms, and for January-June delivery £11 12s. 6d. to £11 15s.; but ordinary makes are selling upon Beckton terms at £11 2s. 6d. to £11 3s. 9d., while London f.a.s. terms are the same. The Hull value is about £11 3s. 9d. to £11 5s.; and in Liverpool £11 5s. to £11 5s. 3d. is asked. In Leith, manufacturers are very firm indeed in their ideas; quoting £11 10s. for prompt, and £11 15s. for January-June.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a little more activity in the coal trade; but prices do not show any rapid movement at present. In the steam coal trade, best Northumbrians are quoted from 10s. 10d. to 11s. 3d. per ton f.o.b. There is a steady inquiry for second-class steams; and the prices vary from 10s. to 10s. 6d. per ton. For steam smalls, the request is fair, and the price is from about 5s. to 6s. The collieries are working a little better than they have been; but the output is still scarcely normal. In gas coals, the home demand is now beginning to increase more steadily; and the exports are fair. Durham gas coal varies in price according to quality. The usual classes are from 10s. to about 11s. 1½d. per ton f.o.b., and "Wear specials" up to about 11s. 7½d. Forward sales are being made; and while about 11s. is offered for best gas coals over next year—at which a few sales were made a short time ago—up to 11s. 4½d. per ton f.o.b. is now asked by some of the collieries who have a fair proportion of their output sold. Coke is firmer; and gas coke is influenced, even though the output is increasing. Good gas coke is quoted from 13s. to 13s. 6d. per ton f.o.b. in the Tyne or Wear.

Scotch Coal Trade.

Trade remains as it was. There is no improvement in the home demand, and the foreign market is not strong, the most encouraging feature of it being inquiries which are being made for forward delivery. The prices now quoted are: Ell 8s. 9d. to 10s. 3d., splint 9s. 9d. to 10s.,

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and steam 9s. 3d. to 9s. 6d. per ton f.o.b. Glasgow. The shipments for the week amounted to 321,597 tons—an increase of 26,139 tons upon the previous week, but a decrease of 15,293 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,486,191 tons—582,196 tons more than the corresponding period.

The Bermondsey Explosion.—In regard to the gas explosion in Grange Road, Bermondsey, early in the present year, and the legal proceedings which have been instituted by the Bermondsey Borough Council against the Metropolitan Water Board, the South Metropolitan Gas Company, and the London County Council, negotiations have been opened between the parties; and in view of this, the trial of action has been postponed until the Hilary Sittings.

Gas-Mains and Motor Traffic.—At their monthly meeting, the Slough Urban District Council referred to the Highways Committee the following letter which had been received from Mr. Arthur Thomas, the Secretary to the Slough Gas Company: "I am desired by the Directors to write to you stating that very serious damage is being done to the Company's mains by the heavy traffic carried on by traction engines under the provisions of the Board of Trade's Heavy Motor-Car Order, 1904. The Directors feel that they must take some action to protect the property of the Company; and as large ratepayers in the urban district, they would be glad to know whether they would have the sympathy, and as far as possible the assistance, of the Council in the matter. The Directors also feel that it is a matter affecting the Council, and the ratepayers generally, as great damage is caused to the roads, and great discomfort, if not damage, to the houses, by this traffic."

Electric Light Failure at Sydney.—Electricity is evidently much the same all the world over. Sydney, we learn, has recently suffered from two failures of its electric lighting. The first was on a Sunday evening; and the second, on Friday, Aug. 13. The latter, which occurred at 6 o'clock in the evening, has roused "many indignant business people"—the indignation being presumably largely owing to the fact that, as reported by a local paper, no official explanation was forthcoming of the mishap. Streets were in darkness, as were also many shops, hotels, &c.; but a more serious aspect of the matter is one which it has unfortunately been previously necessary to draw attention in these pages. This is what the newspaper report says: "In addition to the inconvenience caused to business people, the failure of the light caused trouble at more than one hospital. At the Sydney Hospital an operation was being performed. Luckily, gas was available; and the operation was completed without harm to the patient by the delay which the failure of the light caused. There is no gas at the Children's Hospital, Camperdown; and candles took the place of the snuffed-out electricity. Nurses moved about with these feeble illuminators stuck hastily into the necks of bottles. The candles proved reliable." It is not pleasant to think of what might have happened at the first-named hospital had not the more reliable alternative gas been available.

Fatality at a Gas-Works.—A fatal accident of a somewhat strange character is reported from Neyland, in Pembrokeshire. It seems that a Mrs. Matthias shared the popular belief in the efficacy of a visit to a gas-works as a remedy for whooping-cough, and accordingly took her young son who was suffering from the complaint to the works which are used by the Great Western Railway Company for gas manufacturing purposes. While there, however, an explosion, from some cause or another, took place; and the consequent outburst of flame so severely burnt the mother that she died in a few minutes. A man named Garnett took the child from her arms; and in doing so, he was badly burnt. When the boy reached the Haverfordwest Infirmary, his condition was such that it was not expected he would recover.

The Gas Question at Sudbury.—A deputation of members of the Sudbury Town Council who recently interviewed the Directors of the Gas Company, reported that their arguments were listened to with great attention, and that, in reply, the Directors pointed out that they were about to seek a Provisional Order, or, if needful, a short Act of Parliament, which would be submitted to the Council in due course, as they were anxious to deal with the matter in a fair spirit and without antagonism to any existing authority. They further stated that, as they they had had the working of the gas undertaking such a short time in their hands—only since March last—they were unable for the present to make a greater reduction in the price of gas than that announced in their recent circular; but they hoped with a riper experience they would be placed in the happy position of being able to make further reductions. Any way, they had agreed that there should be inserted a clause in the Provisional Order providing for a maximum dividend, any profits beyond which would go to the reduction in the price of gas to the consumers.

The Lighting and Watch Act at Hellifield.—The President of the Local Government Board was asked in the House of Commons a few days ago by Mr. Clough whether he was aware that, under the Lighting and Watch Act, it was incumbent upon the Hellifield parish to have their annual meeting in October for the purpose of the administration of the Act; whether he had received a communication from the Hellifield Parish Council explaining that it was very inconvenient and unbusinesslike that the meeting should be held after the lighting season had commenced and contracts for gas and lamp-lighting had been entered into; whether the vote approving of these provisions for last year was only carried by the casting vote of the Chairman; and whether he could make an order altering the date of the parish meeting from October to September, or some earlier month, so as to render more smooth the working of the Lighting and Watch Act. In reply, Mr. John Burns said he had received a communication from the Parish Council to the effect stated in the question. He was not empowered to issue any order in the matter; but he was not aware of any objection to the parish meeting for determining the amount to be raised for the purposes of the Lighting and Watch Act, 1833, being held in September or some earlier month, if this was deemed convenient. He had informed the Parish Council accordingly.

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THE INTRODUCTION OF THE SLOT METER.

WRITING to supplement the information given in our "Questions and Answers" column last week with regard to the introduction of the slot meter, a correspondent says that the first patentee was Mr. W. Brownhill, but his meter was never in practical use. The first Gas Company to supply gas in quantity through slot meters was the Liverpool United Gas Company. They supplied gas in bulk to the Corporation for the artisans' dwellings in Casino Street, Liverpool. The Corporation fixed 50 penny-in-the-slot meters in these dwellings. The meters were Thorp and Marsh's patent, and they were manufactured by Messrs. Sawer and Purves. The meters were fixed for six months on approval, at the end of which time the Corporation had to decide whether they were a success or failure. Mr. Marsh entered into a guarantee that the meters should be satisfactory, and he undertook liability for any accident that might occur. Our correspondent adds that he has no hesitation in saying that Sir George Livesey was the first man controlling a gas undertaking to strenuously advocate the use of the slot meter.

GAS v. ELECTRICITY

(From the GAS WORLD.)

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MILES PLATTING, RADFORD ROAD,

MANCHESTER, GLASGOW, NOTTINGHAM.

Man Poisoned by Gas in Port Glasgow.—Last Wednesday John O'Carrigan, a butcher at Ballintoy, County Antrim, arrived in Scotland, and went to reside with a friend at No. 2, Springhill, Port Glasgow. Neither man was seen on Thursday; and in the evening neighbours informed the police, who effected an entrance to the house. In one of the rooms, in which there was a strong smell of gas, O'Carrigan was found in bed unconscious. He was taken to Greenock Infirmary, where he died on Friday morning, from the effects of poisoning by coal gas. The police theory is that the man blew out the gas light when he retired on the Wednesday evening.

Any Offers for the Robertsbridge Gas-Works?—Under date of the 15th inst., Mr. Henry G. T. Davies, the Receiver and Manager of the Robertsbridge, Salehurst, and Hurst Green Water and Gas Company, Limited (one of the No. 99, Cannon Street promotions), has issued a circular-letter stating that he was appointed by Mr. Justice Eve, on July 31, on behalf of the debenture holders, in an action brought by Mrs. Susannah Meadows, and that he is to act until Oct. 31. He adds: "I have taken possession, and am carrying on the business. As soon as possible, when the Courts re-open, I shall ask for permission to sell. Meanwhile I shall endeavour to obtain offers for the property which I can put before the Court. It would be useless to try to carry on the business without further capital for development, so that I do not think I can suggest any scheme of re-construction. If any debenture holder would be inclined to make an offer for the business, I shall be pleased to give particulars of the plant, &c."

A Secretary's Death from Gas Poisoning.—An inquest has been held at Henley-in-Arden upon the body of George Alfred Burton (aged 47), who was Secretary of the local Gas Company and of the Lodge of Oddfellows. Deceased was found in his office dead, apparently suffocated by gas. The evidence showed that Burton had failed to account for some of the gas funds, and was summarily dismissed. His father, who was guarantee for him, met the Company in a straightforward manner; and Burton made preparations for the handing over of the books and documents to his successor. He was discovered by his twelve-year-old daughter, who went to rouse him, thinking he was asleep. A piece of tubing, fixed to a tap, was found by deceased's chair. The Jury returned a verdict that death was due to accidental suffocation, caused by an escape of coal gas, and expressed their sympathy with the widow and six children. Mr. C. Couchman, J.P. (the Chairman of the Company), said until the unfortunate lapse Mr. Burton enjoyed the implicit confidence of the Directors.

Satisfactory Year at Falmouth.—Presiding recently at the annual meeting of the Falmouth Gas Company, Major F. Mead, the Chairman, congratulated the shareholders on the very satisfactory position of the undertaking. The report was the best he had known since the formation of the Company. They had 125 new customers during the year; and favourable contracts having been made for coal, the price of gas to ordinary consumers was reduced at Christmas last to 3s. 6d. per 1000 cubic feet. They were supplying a good article at a cheap price, and could look forward with confidence to the future. He believed gas was cheaper in Falmouth than anywhere else in Cornwall. Mr. W. Rowe, in seconding the adoption of the report and accounts, said that, by supplying cheap gas and free incandescent burners, they were conferring a benefit on the working classes, while also serving the interests of the shareholders. The balance-sheet, which showed a profit of £2542, was adopted; and the dividend of 5 per cent. declared—½ per cent. placed to the reserve fund, and ½ per cent. to the renewal fund.

Proposed National Smoke Abatement Movement.—A Smoke Abatement Conference was held at the Sheffield Town Hall last Tuesday, when the unanimous opinion was expressed that some decisive action should be taken to secure an abatement of the smoke nuisance. The opinion of the meeting seemed to be that the Local Government Board could do a good deal to remedy the evil by appointing inspectors to report on those local authorities who neglect their duty to the public by not enforcing their powers. After considerable discussion, the following resolution, proposed by Principal J. W. Graham, of Manchester, was passed: "That a Provisional Committee, with power to add to their number, be and are hereby appointed to consider the best means of promoting a strong national movement for furthering smoke abatement, and to carry on such work till a permanent organization can be formed; and that it be the first duty of such Committee to organize a deputation from the principal towns in the North and others to wait upon the President of the Local Government Board." It was also decided to form an Association to deal with the question of smoke abatement; Messrs. W. Basforth, of Sheffield, and F. Scott, of Manchester, being appointed Hon. Secretaries.

Salford Council and their Contracts.—An adjourned meeting of the Salford Town Council last Wednesday approved of a resolution amending one passed on Sept. 7, 1904, with reference to the payment of the standard rate of wages by persons obtaining Corporation contracts. In effect, the new resolution stipulates that the holders of a contract "must then and at all times during its execution be paying to the whole of their workpeople (except such as may be employed under special provisions agreed upon by the employers and the organized bodies of workers) the standard rate of wages in the several districts where their workpeople are actually engaged in the execution of work;" and must also be observing the recognized hours and conditions of labour, and must not prohibit their workpeople from joining trade societies or continuing members of such bodies. Mr. Purcell, who moved the resolution, said its object was to enforce that at all times the standard rate and the standard hours should be adopted by contractors tendering for work under the Corporation, also all other conditions of trade union labour. Alderman Phillips, the Chairman of the Gas Committee, expressed the opinion that there was no more dangerous matter to touch than that affecting the relation of employers and employed. He sympathized with all efforts to put the conditions of labour on a fair and equitable basis; but he did not think the Council were the right body to decide what was the custom of trade and what were the conditions of labour when the employers and employed themselves had not been able to do it. He was not prepared, however, to move an amendment to the resolution before the Council.

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On the recommendation of the Highways Committee, the Carnarvon Town Council have agreed that the offer of the Gas Committee to supply tar free of cost for the purpose of experimenting on roads be accepted.

The Berkhamstead District Council lately considered a report from the Highways and Works Committee recommending a trial of Rostin controllers, with double inverted burners, for three months in the lamps in certain streets. The Chairman (Mr. Cooper) pointed out that this automatic lighting system had been working in Tottenham and Edmonton for some time, with satisfactory results.

The Bromley and St. Mary Cray Gas Company, after having tested about eighty of the "Gunfire" controllers for four years, have purchased, and have just completed fixing, these controllers to the whole of their lamps in the St. Mary Cray district; and last week the Calne Town Council renewed their agreement for the lighting of the whole of their lamps with the "Gunfire" controllers, after having used the system for about five years. Many other towns have done likewise, which, doubtless, will be accepted as ample proof of the success of this particular system.

Messrs. Timmis and Co., of Stourbridge, have prepared a very artistic catalogue to illustrate, by photographs, the various classes of goods they make from Stourbridge fire-clay, and to some extent the process of manufacture—thinking it may be helpful to both merchant and consumer to be able to familiarize themselves with the material they purchase, and the conditions under which it is raised from the earth and manufactured. Besides over thirty excellent reproductions of photographs of works, plant, and material, the catalogue contains a short account of the manufacture of fire-bricks, supplied by Mr. Timmis, by request, for use by the metallurgical students of the University of Birmingham.

The Topsham and District Water Company has been registered, with a capital of £3000, in £5 shares.

During the twelve months preceding June 30 last, the Keighley Corporation Gas Department made a net profit of £6191, out of which it is intended to use £5550 for the relief of the rates. It is proposed to reduce the price of gas by 1d. per 1000 cubic feet, making it 2s.

The ceremony of diverting the River Lea into a new channel took place on Saturday afternoon. The diversion was rendered necessary owing to the land through which the river flowed being required for the new Chingford Reservoir of the Metropolitan Water Board.

At a meeting of the St. Thomas Rural District Council last week, a letter was read from the Exeter Gas Company in reply to a complaint with reference to the laying of the gas-main at Alphington. This stated that notice was sent to the Surveyor on July 19, and the work was not commenced until July 23. The assertion therefore that the notice was given after the work was done, was incorrect. The statement made that the Company again broke up the road on Sept. 2 without notice was also wrong. The men were only repairing the existing trench. The Company had not the slightest desire to treat the road authority and their officials otherwise than with the utmost courtesy; and in practice they always wished to, and did, give due and proper notice for the opening of public roads. The Surveyor said the Company opened the road from side to side, and did more than was necessary to repair mains. He had had no notice of this. With regard to the other work, it had been on four days when he received notice. Mr. Maunder remarked that it was perfectly absurd of the Company to say that they were only repairing. They dug up the road, and laid fresh gas-pipes. The Clerk was directed to reply that the Council had nothing to withdraw, and hoped that such irregularities would not occur again.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS ENGINEER AND MANAGER. Carlisle Corporation. Applications by Sept. 25.
ACCOUNTANT, &c. Merthyr Tydfil Gas Company. Applications by Sept. 28.
TRAVELLER. No. 5138.
STOKERS. Chertsey Gas-Works.

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Patent Licence.

METERS. Haseltine, Lake, and Co., Chancery Lane, W.C.

Stocks and Shares.

ASCOT GAS AND ELECTRICITY COMPANY. Oct. 12.
BRIXHAM GAS COMPANY. Sept. 30.
LOWESTOFT WATER AND GAS COMPANY. Oct. 12.
SOUTHEND WATER COMPANY. Oct. 12.
TONBRIDGE WATER COMPANY. Oct. 1, 1909.

Meeting.

BRITISH GASLIGHT COMPANY. London Offices, Sept. 29, Twelve o'clock.

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RHONDDA GAS AND WATER DEPARTMENT. Tenders by Oct. 1.

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Lead, Compo Pipe, and Tin.
RHONDDA GAS AND WATER DEPARTMENT. Tenders by Oct. 1.

Purifiers, &c.
BIRKENHEAD GAS DEPARTMENT. Tenders by Oct. 14.

Tar.
MARKET HARBOROUGH GAS DEPARTMENT. Tenders by Sept. 27.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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JOHN RUSCOE AND COMPANY, LIMITED.
TRADE NOTICE.
THE above Firm is in Course of Re- construction, and the Business will be carried on as usual under New Management.

LABORATORY—Advertiser desires Employment in a Gas-Works or other Technical LABORATORY. Holds distinctions in Science and Chemistry, and has passed London Matric. Four years at Hartley University College. Some experience in Teaching Science.
Address Hulbert, Westbury, Wilts.

WANTED, Two Good Stokers for the Winter Months.
Apply to the Manager, Gas-Works, Chertsey.

TRAVELLER required with good Con- nection among Gas and Water Companies and Public Authorities. Whole time required. All Applications treated with strictest confidence.
Apply, by letter, to No. 5138, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

MERTHYR TYDFIL GAS COMPANY.
WANTED, a thoroughly experienced GAS ACCOUNTANT, capable of carrying out the SECRETARIAL DUTIES and TAKING CHARGE of Office Staff.
Salary, £175 per Annum.
Applications, stating Age and Experience, with *copies* only of Three recent Testimonials, to the undersigned on or before Sept. 28 inst.
James E. Kenshole,
General Manager.
Gas Offices, Gas-Works,
Merthyr Tydfil, Sept. 4, 1909.

CITY OF CARLISLE.
APPOINTMENT OF GAS ENGINEER AND MANAGER.
THE Corporation of Carlisle are pre- pared to receive APPLICATIONS for the APPOINTMENT of ENGINEER and MANAGER of their Gas-Works.
Candidates for the Appointment may obtain a statement of the duties of the Office and Conditions of Candidature on Application to the Town Clerk, Carlisle.
The Candidate to be appointed must be a duly qualified Gas Engineer and Manager, not exceeding 45 years of age, and will be required to devote his whole time to the discharge of the duties of his office.
Preference will be given to Candidates having a Practical Knowledge of the Manufacture of Carburetted Water Gas.
The Salary will be £400 per Annum clear of all expenses, rising by annual increments of £25 to a maximum of £500. The Corporation will provide Offices and necessary Staff. No premium Pupils or other Emoluments whatever are attached to the Office; but it will be the duty of the Engineer to instruct such Pupils or Apprentices as the Gas Committee may from time to time decide shall be admitted to the Works.
Canvassing Members of the Council, either directly or indirectly, is strictly prohibited.
Applications, accompanied by printed *copies* of not more than Four recent Testimonials (which will not be returned), to be addressed to me the undersigned Town Clerk, marked "Appointment of Gas Engineer," on or before the 25th day of September next.
By order,
A. H. Collingwood,
Town Clerk.
Carlisle, Sept. 14, 1909.

WANTED, a Second-Hand Washer Scrubber, Kirkham-Hulett's or Holmes' make, 250,000 or 300,000 Cubic Feet per Day Capacity, to be driven by its own Engine, with necessary Bye-Passes and Valves.
Send full Particulars to No. 5139, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SECOND-HAND Station Meter by Parkinson FOR SALE. Capacity, 20,000 Cubic Feet per Hour. Cylindrical Tank, fitted with Clock and Tell Tale. First-Class Condition. Just thoroughly Overhauled.
Address No. 5137, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GASHOLDERS—Splendid, 45 feet diameter, and New STEEL TANK fixed complete, to Plan and Specification. Also 50 feet Single-Lift and 50 feet Double-Lift. Cheap, with STEEL TANKS. Can be seen temporarily erected.
FIRTH BLAKELEY'S, Thornhill, DEWSBURY.

PURIFIERS—Set of Four, 12 feet Square, fixed complete. A bargain. Also Four 6 feet Square, Two 8 feet, Four 8 feet, and Two 12 feet square PURIFIERS. Cheap.
FIRTH BLAKELEY'S, Thornhill, DEWSBURY.

SKIPTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Council invite Tenders for the Supply of GAS FIRES and COOKERS required during the period ending the 30th of June, 1910.
The average number Purchased during each of the past Four Years was 167.
Further Particulars may be obtained from Mr. J. H. Woodward, Manager, Gas-Works, Skipton, and Tenders, endorsed "Gas-Cookers," are to be sent to him on or before the 6th of October, 1909.
RICHARD WILSON,
Clerk to the Council.

MARKET HARBOROUGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

SURPLUS TAR.

TENDERS are invited for the Surplus TAR produced during the Year ending Sept. 30, 1910.
Particulars may be obtained from the undersigned, to whom sealed Tenders, endorsed "Tender for Tar," must be delivered not later than noon on Monday, the 27th inst.
ALFRED T. HARRIS,
Manager and Secretary.
Gas Offices, Market Harborough,
Sept. 10, 1909.

SHEPPY GAS COMPANY.

THE Directors invite Tenders for the Purchase of the whole of their Surplus COKE (estimated at about 2000 Tons), or for part thereof, which will be produced between the 1st of October, 1909, and the 30th of September, 1910. Rail and Water facilities.
Tenders to be sent in, to the undersigned, not later than Wednesday morning, the 29th inst.
The Directors do not bind themselves to accept the highest or any Tender.
H. BARBER,
Secretary and General Manager.
Gas Offices, 22, Edward Street,
Sheerness, Sept. 2, 1909.

RHONDDA URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

THE Council are prepared to receive TENDERS for the following:—
1.—For the Supply of LEAD and COMPO PIPE and BLOCK TIN for the Half Year ending March 31, 1910, upon our Form of Tender, which may be had from the Engineer and Manager.
2.—For a Horizontal STEAM-ENGINE and EXHAUSTER, to pass 60,000 Cubic Feet of Gas per Hour for their Porth Gas-Works (Contract No. 48.)
Plans and Specifications for Contract No. 48 may be seen, and Forms of Tender obtained, upon Application to Mr. Octavius Thomas, the Engineer and Manager, Gas and Water Offices, Pentre, Rhondda, upon depositing the sum of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender, but to be forfeited in the case of withdrawal of Tender after acceptance by the Council.
The Contractor will be required to pay the Standard Rate of Wages recognized in the District.
Tenders to be addressed to the Chairman of the Gas and Water Committee, endorsed "Lead and Compo, &c.," or "Contract No. 48," and delivered at my Office not later than Ten a.m., Friday, Oct. 1, 1909.
The Council do not bind themselves to accept the lowest or any Tender.
WALTER P. NICHOLAS,
Clerk to the Council.
Public Offices, Pentre,
Rhondda, Sept. 15, 1909.

COUNTY BOROUGH OF BIRKENHEAD.
(GAS DEPARTMENT.)

PURIFIERS, &c.

THE Corporation of Birkenhead invite TENDERS for the Supply and Erection of Four Cast-Iron PURIFIERS, 40 ft. by 35 ft. by 5 ft., together with Steel Superstructure, Valves, Connections, Engine-House, Oxide Elevator, &c.
Copies of the Specification and Eight Drawings can be obtained by Approved Applicants on payment of Three Guineas.
The Corporation will not feel justified in accepting a Tender from any Firm not having had Experience in similar work.
The Person whose Tender may be accepted will be required to enter into a Contract containing a clause as to the payment of the Rate of Wages and the observance of the Hours of Labour recognized and agreed upon between the Trades Unions and the Employers in Birkenhead or in the locality in which the work for carrying out the Contract is executed as the case may be.
Tenders, sealed and endorsed "Gas-Purifier," to be sent in to me not later than Five p.m., on Thursday, the 14th of October, 1909.
The Corporation do not bind themselves to accept the lowest or any Tender.
By order,
J. FEARNLEY,
Town Clerk.
Town Hall, Birkenhead,
Sept. 18, 1909.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 750 NEW ORDINARY FIVE PER CENT. MAXIMUM £10 SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 12, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
LOWESTOFT WATER AND GAS COMPANY.

NEW ISSUE OF 400 ADDITIONAL ORDINARY £10 SHARES,
AND
£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 12, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ASCOT DISTRICT GAS AND ELECTRICITY COMPANY.

NEW ISSUE OF £2520 FOUR-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK,
AND
200 £10 NEW ORDINARY SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 12, at Two o'clock, in Lots.
Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

TONBRIDGE WATER-WORKS COMPANY, LIMITED.

ISSUE OF 100 £5 "C" SHARES BY TENDER.
AS AUTHORIZED BY THE TONBRIDGE WATER-ORDER OF 1900.

THE Directors of the Tonbridge Water- Works, Company, are prepared to receive APPLICATIONS for the above on or before Oct. 1, 1909.
Particulars, with Form of Tender, can be obtained on Application to the Secretary, JAMES LEES, 4, The Terrace, TONBRIDGE.

BRIXHAM GAS COMPANY.

SALE OF 200 7 PER CENT. ADDITIONAL ORDINARY SHARES OF £10 EACH.

MR. S. F. Dugdall is instructed by the Directors to SELL BY AUCTION, at the Town Hall, Brixham, Devon, on Thursday, the 30th of September, 1909, at Six p.m. precisely, in Separate Lots, 200 ADDITIONAL ORDINARY SHARES of £10 each, entitling the Holders to a standard dividend of 7 per Cent. (subject to the Sliding-Scale based on the Price of Gas).
The Standard Price of Gas is 4s. per 1000 Cubic Feet.
The Company was established in 1838 and incorporated by Special Act of Parliament on the 24th of June, 1904, and supplemented by the Brixham Gas and Electricity Act, 1906.
The Capital now being issued is required to meet expenditure in respect of Various Extensions.
Detailed Particulars of Sale obtainable post free from the OFFICES of the Company, Fore Street, BRIXHAM; W. A. SCHULTZ AND CO., Chartered Accountants, 50, Cannon Street, LONDON, E.C.; Mr. W. L. PARSONS, Solicitor, Brixham, DEVON; and the AUCTIONEER, Mr. S. F. DUGDALL, Brixham, DEVON.
Sept. 1, 1909.

BRITISH GASLIGHT COMPANY, LIMITED.

NOTICE is Hereby Given, that the HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors of this Company will be held at this Office on Wednesday, the 29th inst., at Twelve o'clock precisely, to transact the usual Business; to declare a Dividend for the Half Year ended the 30th of June last; to elect two Directors in the place of those who go out by rotation; and to appoint two Auditors.
AND NOTICE IS HEREBY ALSO GIVEN, that at such Meeting a Resolution will be submitted to the Proprietors dealing with the payment by the Company of Income Tax in respect of the Remuneration of the Directors and Auditors.
The TRANSFER BOOKS of the Company WILL BE CLOSED on the 18th inst. and RE-OPENED on the 30th inst.
By order of the Court of Directors,
A. W. BROOKES,
Secretary.
Chief Office: No. 11, George Yard,
Lombard Street, London, E.C.
Sept. 8, 1909.

THE Proprietors of the Patent No. 19,479 of 1905, for "IMPROVEMENTS IN OR RELATING TO METERS," are desirous of entering into Arrangements by way of LICENSE and otherwise, on Reasonable Terms, for the purpose of EXPLOITING the same and ensuring its Full Development and Practical Working in this Country.
All Communications should be addressed in the first instance to HASELTINE, LAKE, AND CO., Chartered Patent Agents and Consulting Engineers, 7 & 8, Southampton Buildings, Chancery Lane, LONDON, W.C.

Testing Instruments.
ALEXANDER WRIGHT & CO., LD.
WESTMINSTER.

The Manufacturers of the best and cheapest
GAS QUICK HEATERS
are
OTTO LOEB & CO.,
BERLIN, S.W.61.
Ask for Samples and Price List.

MUNICH
INCLINED CHAMBERS.

Sole Agents and Licensees for Great Britain and Colonies:
The Coke Ovens & By-Products Co., LTD.,
Palace Chambers,
Westminster, LONDON, S.W.

JOHN COATES & CO., LTD.,
Gas and Water Works Engineers, Inspectors, and Merchant Shippers,
5, Laurence Pountney Hill, LONDON, E.C.

NOTE. Much expense and trouble is often saved by Colonial and Foreign Gas and Water Companies, and City Corporations, by having their requirements from Great Britain bought or properly inspected by practical men. We have a staff of experts for Buying, Shipping, and Inspection, of Gas Plant and Machinery of every description, Cast Iron Pipes, &c., and may add that our Engineering Branch is under the direction of Mr. John Coates, M.Inst.C.E., and Shipping Branch under Mr. Alfred J. Kingdon, both with over 20 years' experience.
J. C. & Co.

MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.

Please apply for Price, Analyses, and Report, to the
MIRFIELD (GAS COAL) COLLIERIES
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 16, Park Village East, N.W.

JOHN HALL & CO. OF STOURBRIDGE,
LIMITED,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

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BRETTELL'S ESTATE, LIMITED,
FIRE-CLAY & BRICK WORKS,
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Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

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SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
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NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
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NEWBATTLE COLLIERIES,
NEWTONGRANGE, MIDLOTHIAN.

'BUFFALO' INJECTOR
Operated Entirely by One Handle.
Class A lifts 24 ft.
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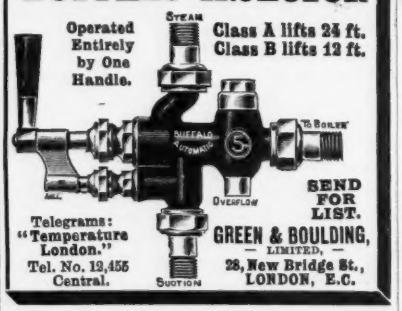

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Telegrams: "Temperature London." Tel. No. 12,455 Central.
GREEN & BOULDING, — LIMITED, —
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HEATHCOTE GAS COAL
from the
GRASSMOOR COLLIERIES,
CHESTERFIELD.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

LUX'S
Gas Purifying Material
is now used in many Gas-Works throughout Scotland with gratifying success.
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Sole Agent for Scotland:
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Descriptive Pamphlet on Application.

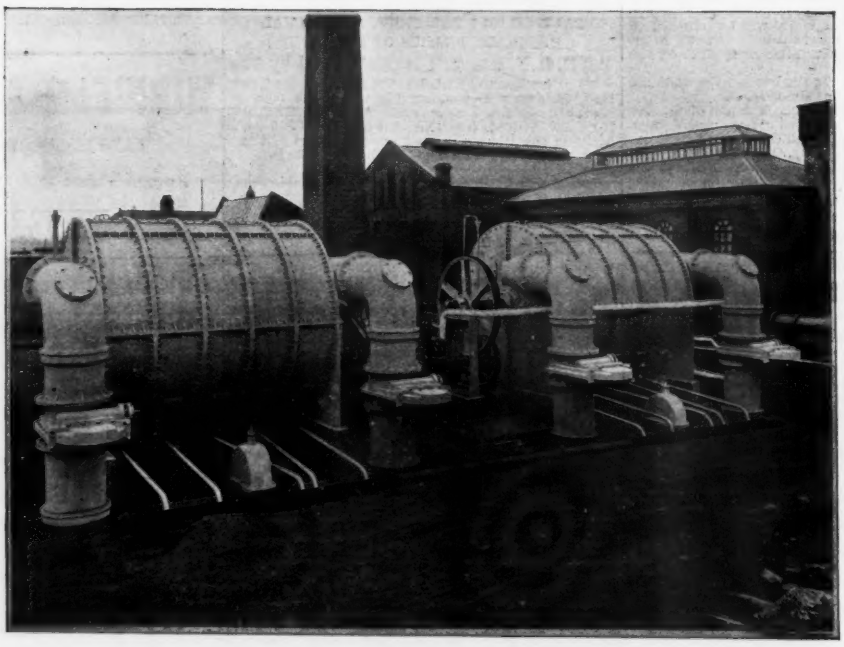
JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

THE WHESSOE FOUNDRY CO., LTD.,

Works: DARLINGTON.

LARGE AREA OF WASHING SURFACE.

REMOVAL OF THE WHOLE OF THE AMMONIA AND A LARGE PERCENTAGE OF CO. AND SH.



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BUNDLES EASILY ACCESSIBLE FOR CLEANING.

"Whessoe" Twin Rotary Washer-Scrubber (Patent No. 24,110 of 1903). **Combined capacity 3,000,000 cub. ft. per diem,** as supplied to The Walker and Wallsend Gas Company, Newcastle-on-Tyne.

London Office: 106, CANNON STREET, E.C.

Rheinische Chamotte-und Dinas-Werke, Cologne on Rhine.

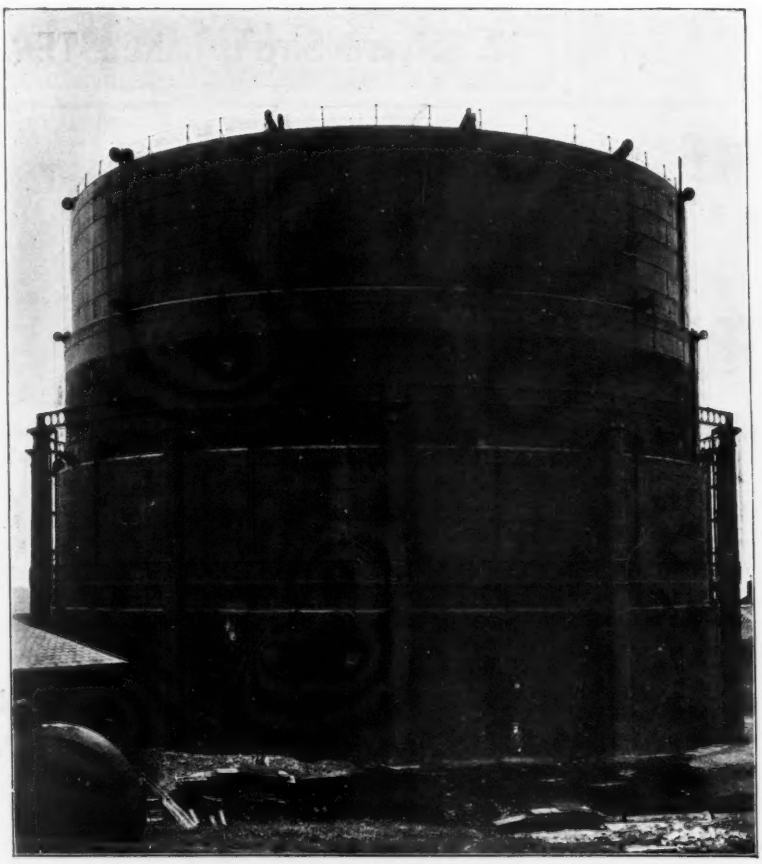
Construction of

Entire Gas-Works & Coke Oven Plants,

Retort Furnaces,

Furnaces for Chamber Settings (*Patent*), **New Coke Ovens** (*Patent*),

With and without Recovery of the Bye-Products, Tar and Benzol Distilleries, Ammonia Works, and Cyanogen Extraction Plants.



RECONSTRUCTION OF AYRES QUAY GAS-WORKS, SUNDERLAND.

(See "Gas Journal," July 6, 1909.)

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100-FEET DIAMETER, 100-FEET HIGH, UPPER LIFTS CABLE-GUIDED

(Pease's Patent).

Makers of every description of Gas-Works Apparatus.

ENQUIRIES SOLICITED.

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Telegrams: "GASHOLDER."

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Gas Retort, Fire-Clay, Red and Blue Brick Works,

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A Handsome F'Cap Volume giving a complete account of the

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GAS COAL AND CANNEL.

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Gas, Steam, and other Fuel for Home and Export.

GAS COKE CONTRACTORS.

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"FLUXITE"

FIRE

CEMENT

For

STOPPING CRACKS IN GAS RETORTS.

Makers: JOHN E. WILLIAMS & CO., Lower Moss Lane, MANCHESTER, S.W.

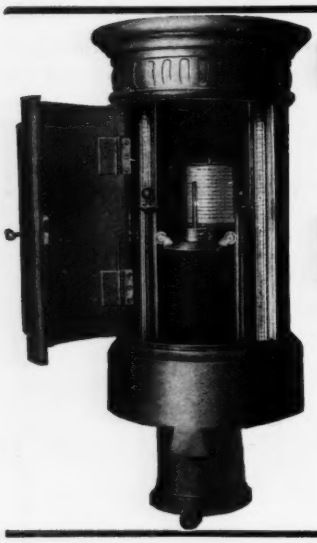
"COALEXLD."

Where this Fuel is Manufactured, **the strongest evidence of its advantages** to the Gas Engineering World **is seen by the absence of Stocks of Coke,** as the daily Sales of **Coalexld** clear the Stock as Manufactured.

For further Particulars, apply to—

COALEXLD LIMITED,

12, Sulyard Street, LANCASTER.



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DISTRICT GOVERNOR

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Ordinary or High Pressure.

PILLAR BOX contains Air-Pressure Holder for Loading the Governor from a distance also Recording Gauge and Inlet and Outlet Pressure Gauges.

LARGE MERCURIAL GOVERNOR.

From a Photo. of 24 in. Size.

May be Loaded by Weights or Air Pressure from a Distance.

NEWTON, CHAMBERS, & CO.,

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THORNCLIFFE IRON-WORKS, near SHEFFIELD.

Established 1790.

LONDON OFFICE: **16, Great George Street, WESTMINSTER.**

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GAS ENGINEERS, IRONFOUNDERS, and CONTRACTORS.

MANUFACTURERS OF EVERY DESCRIPTION OF

PLANT, APPARATUS, AND MACHINERY FOR GAS AND CHEMICAL WORKS.

RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS.

IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS, AND ELEVATORS.

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PURIFIERS with Planed Joints a Speciality.

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STRUCTURAL WORK, COLUMNS, GIRDERS, AND ROOFING.

GASHOLDERS, CAST-IRON OR STEEL TANKS.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (special quality) for Engine Cylinders. **GAS COAL** famous for its Unrivalled excellence.

Laying Mannesmann Weldless Steel Tubes in the Bed of the Tidal River Teign.

(Teignmouth Water Scheme, comprising 14 miles of Mannesmann Tubes.)

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BRITISH MANNESMANN TUBE CO., LTD.,

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Makers of Weldless Steel Spigot and Faucet, Flanged, Screwed and Socketted, &c., Tubes, Tubular Lamp Posts, Drums, Standards, &c., &c.

Works: LANDORE, S. WALES. Telegrams: "TUBULOUS, LONDON."

MAIN LAYING.

Paper by **PERCY GRIFFITH, M.Inst.C.E.**, and **BRUCE McGREGOR GRAY, Assoc.M.Inst.C.E.**, before the Association of Water Engineers.

A. The Authors used *Flanged Pipes* for the Rising Main up the Steep side of the Barff, and their experience proved that this was not an advantage, as *the rigidity of the Joints involved considerable difficulty* in regard to the depth of the Trench, and a good deal of Cutting to make the final Connections at each end of the Pipe-Line.

B. In the case of the Delivery Main, the Joints were *Ordinary Socket Joints*, but made with Lead only. The only difficulty met with here was the necessity for *pouring the Lead in* at a suitable temperature *to prevent it melting the Solid Lead Fillet*, and *running through into the Pipe.*

C. In some of the Smaller Branch Connections, Lead Wool was used, and proved highly successful.

Particulars from

THE LEAD WOOL CO., LTD., SNODLAND, KENT.

EVERITT'S Patent

TAR-FOG EXTRACTOR

AND

NAPHTHALENE REMOVER.

SOLE MAKERS:

ROBERT DEMPSTER & SONS,

ROSE MOUNT IRON-WORKS, LTD.,

ELLAND, Yorks.

THE

"DARWIN"

PATENT

INVERTED BURNERS.

No. 2 "DARWIN." 2¾in. Fitting.
60-Candle power. Medium.

Have been remodelled, and we now offer you

BETTER BURNERS

AT

REDUCED PRICES

And guarantee the highest finish and Workmanship.

Independent Test by a well-known Gas Manager of No. 3 Burner.

CONSUMPTION . . . 3·55 ft.
of Gas at 15/10ths Pressure,

CANDLE POWER . . . 122·76

These figures speak for themselves.

Breakage of Mantles and

MAINTENANCE CHARGES

Reduced to a minimum.

Made in 3 SIZES and 8 PATTERNS

BY

CHARLES JOYNER & CO., LIMITED,

Icknield Square,

BIRMINGHAM.

THE WIGAN COAL & IRON CO., LIMTD.,

Are the exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, Wigan, and of the Manton Steam and House Coal Collieries, Worksop, Notts, and supply the well-known Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, House and Steam Coals, &c.

MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone: No. 200.

LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.* Telegraphic Address: "PARKER, LONDON."

Workmanship and Materials of the Highest Quality.

PECKETT'S LOCOMOTIVES.

Built to any Specification or Gauge.

PECKETT & SONS,
ATLAS LOCOMOTIVE WORKS, BRISTOL.

GEO. R. LOVE'S

INCLINES AT 45 DEGREES.

CARBONIZATION MADE EASY.

A Few Recommendations for this System:—

Simplicity of Design.
No **Machinery** to get out of order.
Carbonizing charges **40 per cent. less** than with Horizontals.
No skilled Stokers necessary.
Yield of Gas per ton guaranteed about 1000 cubic feet more than under present conditions, of guaranteed candle power.
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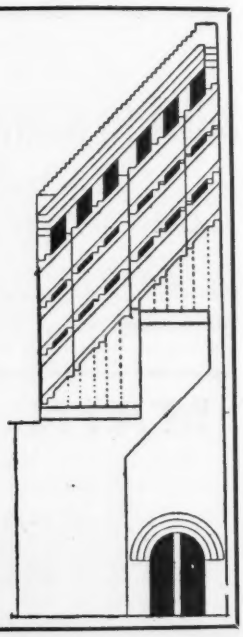

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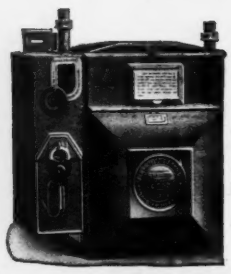

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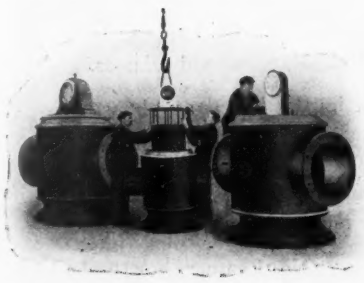

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Gas Company Specialists, **READING.**

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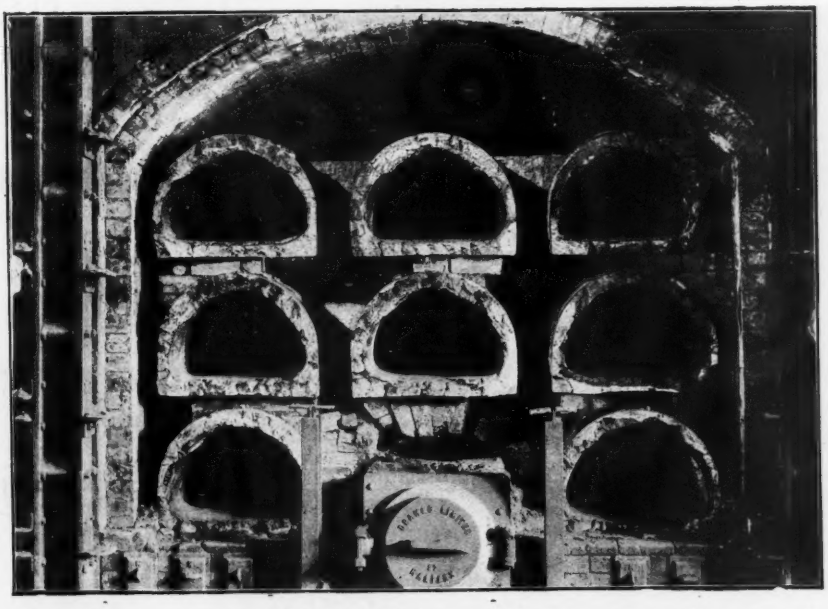

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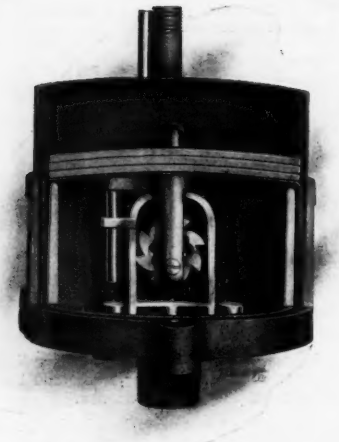

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Saves Labour, Gas, Mantles, and Glasses.

Can be brought into action at any hour.

Requires no Winding.

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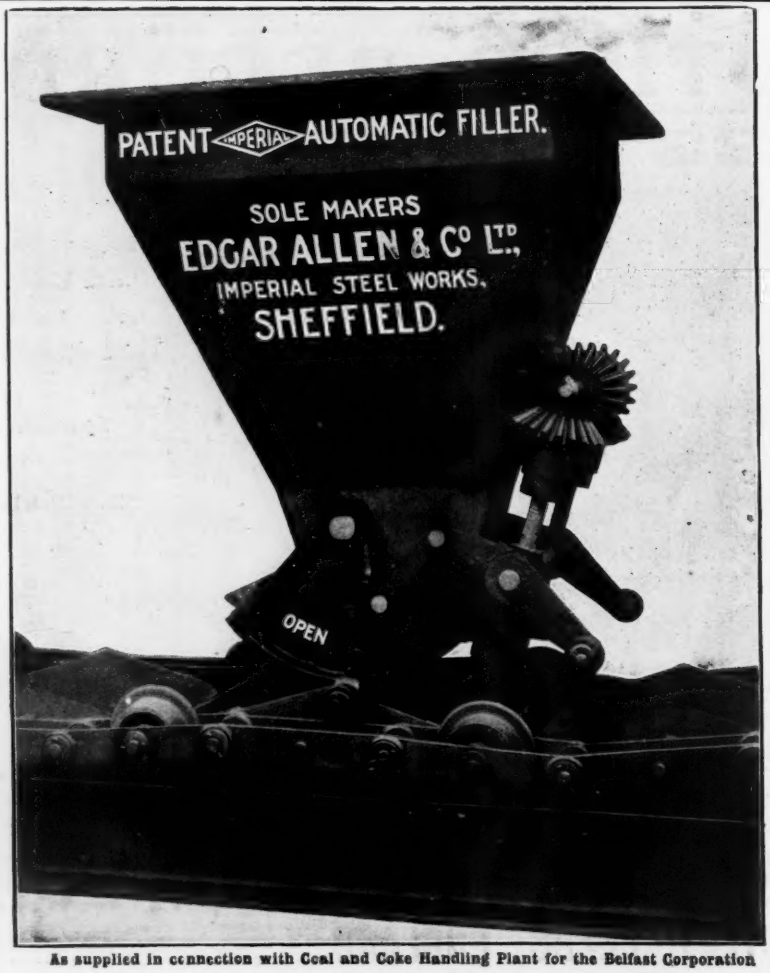

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224,300,000 cubic feet Daily.

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ONE CANDLE
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370 CANDLES
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50 YEARS AFTER.

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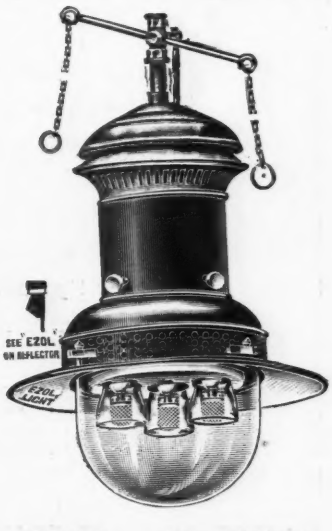

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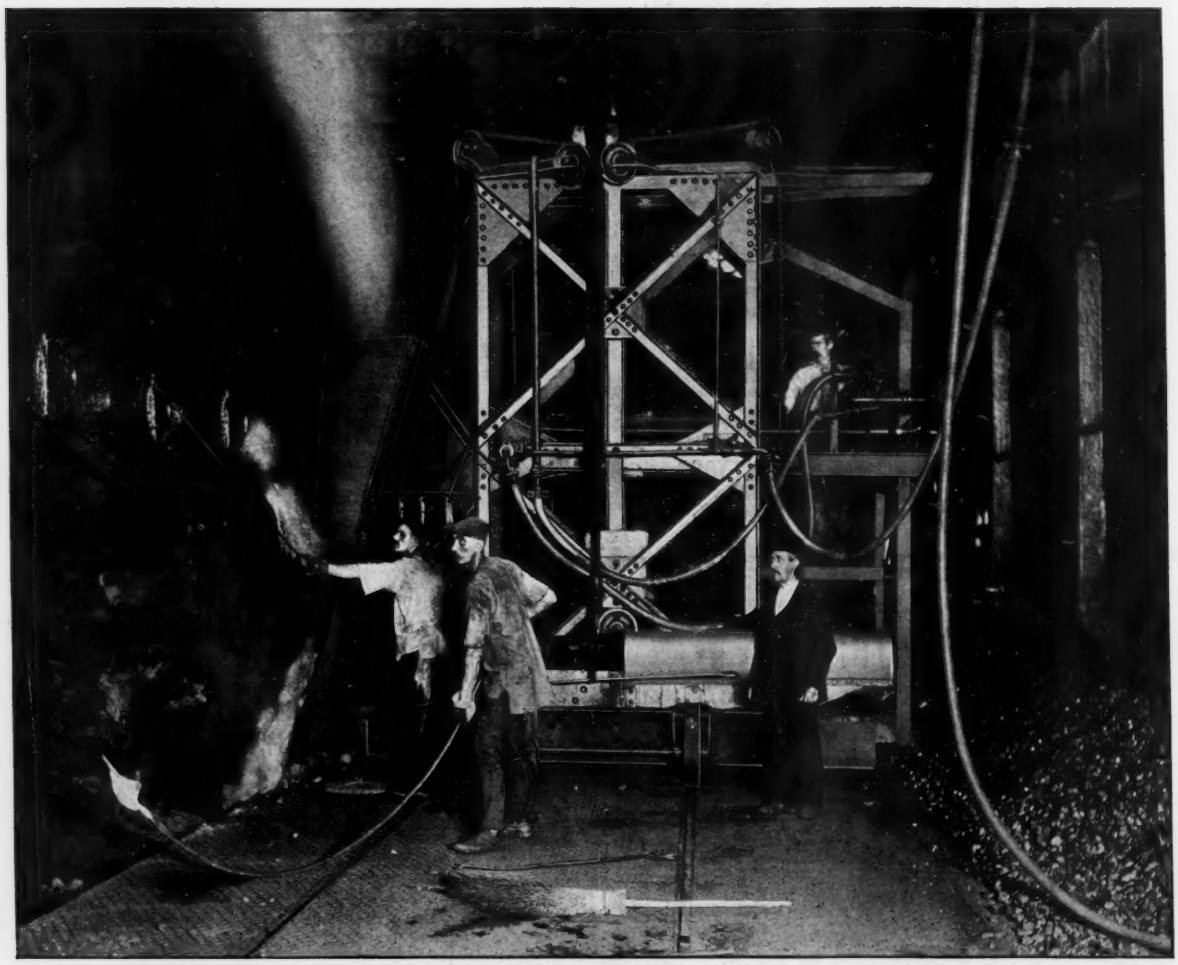

Photograph of New Hydraulic **COKE PUSHER** at work (Hunter and Barnett's Patent).

THE ABOVE MACHINE WILL DISCHARGE A RETORT IN ONE OPERATION.

BY USING IT, THE "LIFE" OF YOUR RETORTS WILL BE MATERIALLY INCREASED; AND THE DESTRUCTIVE "HAMMER-ACTION" INSEPARABLE FROM THE ORDINARY RAKE ENTIRELY DONE AWAY WITH.

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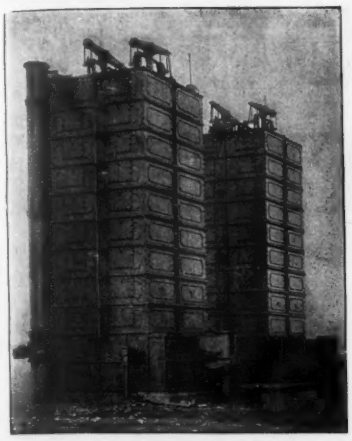

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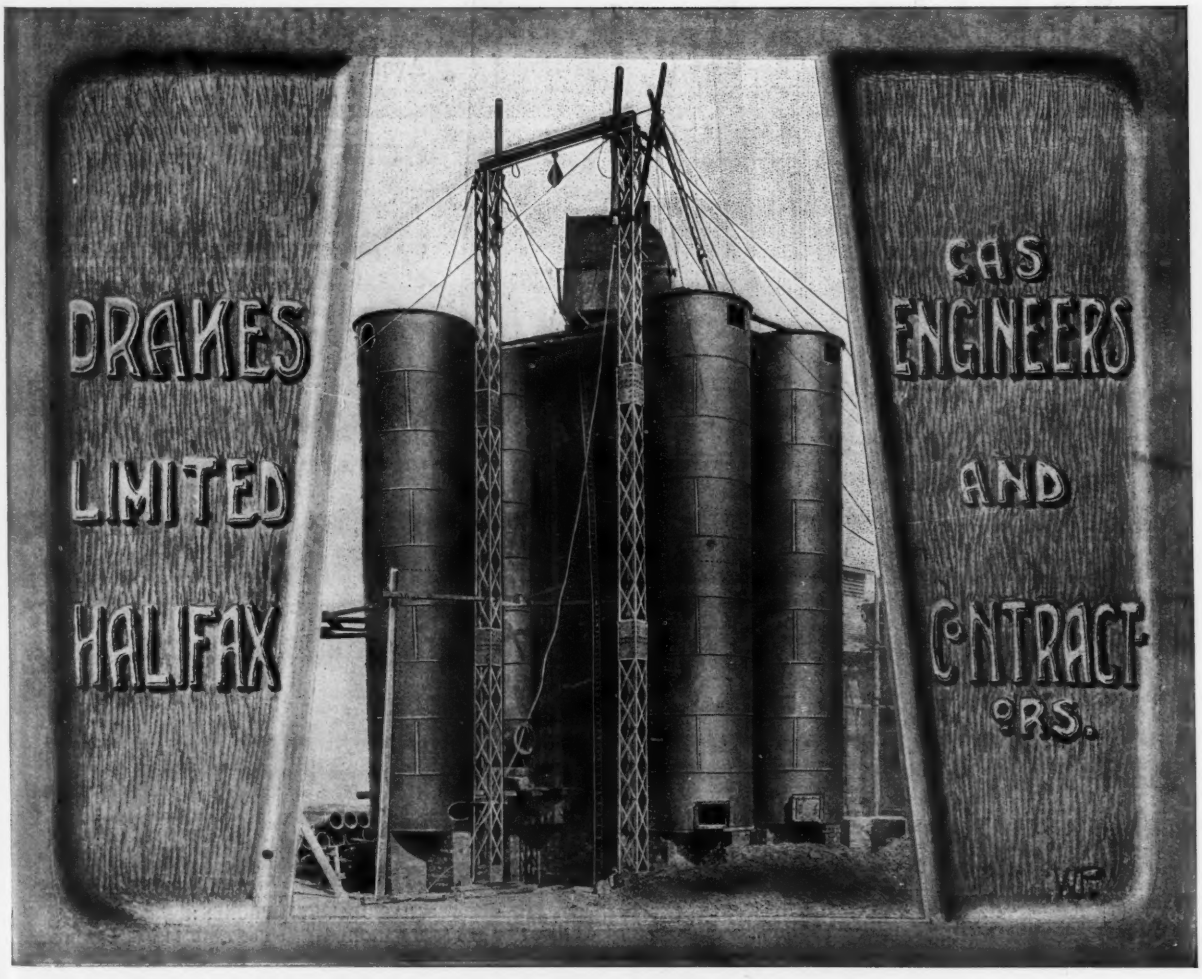

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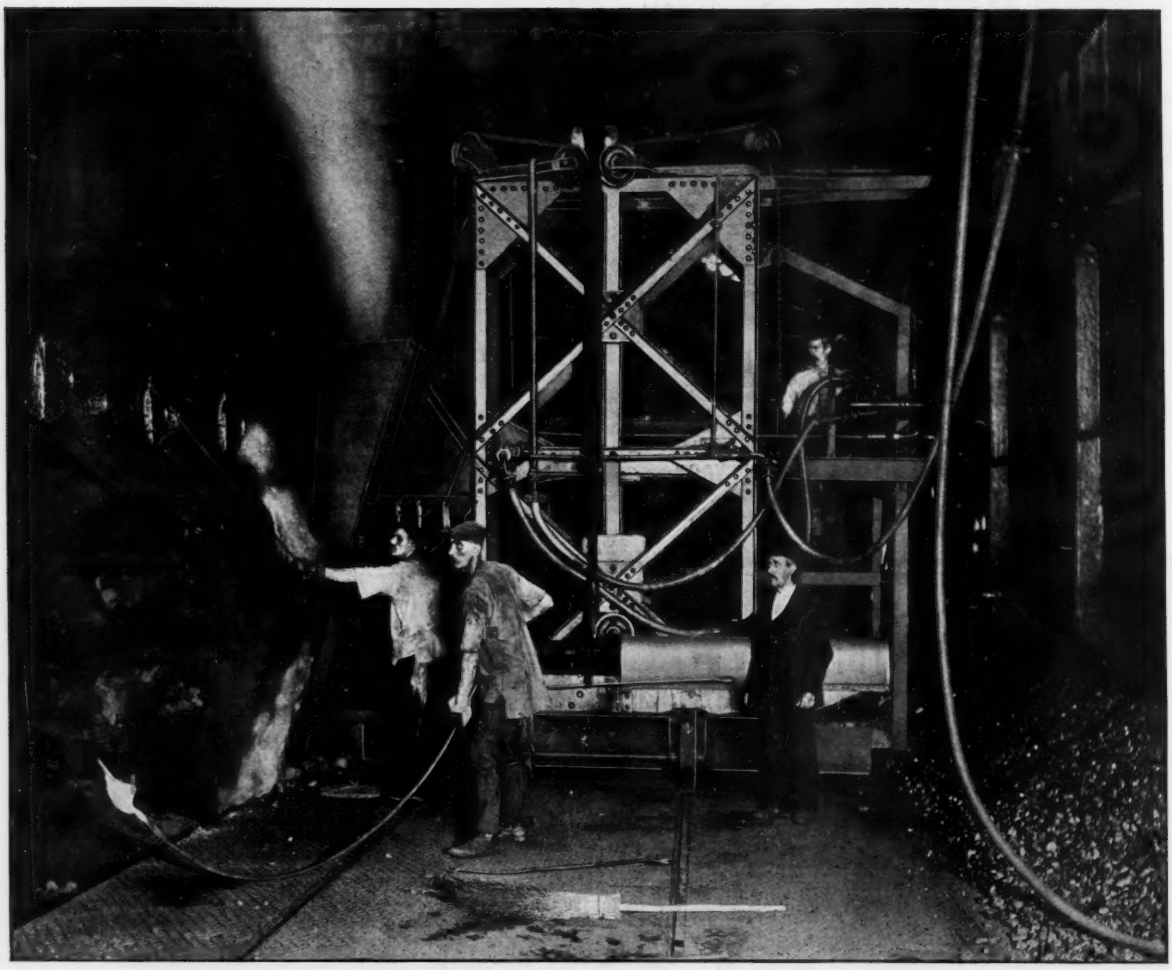

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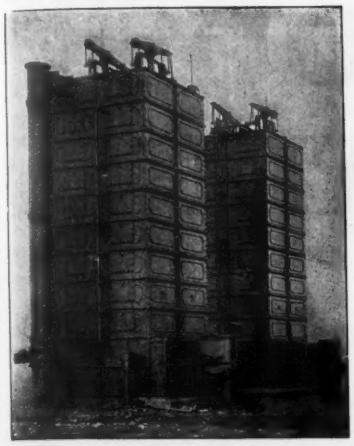

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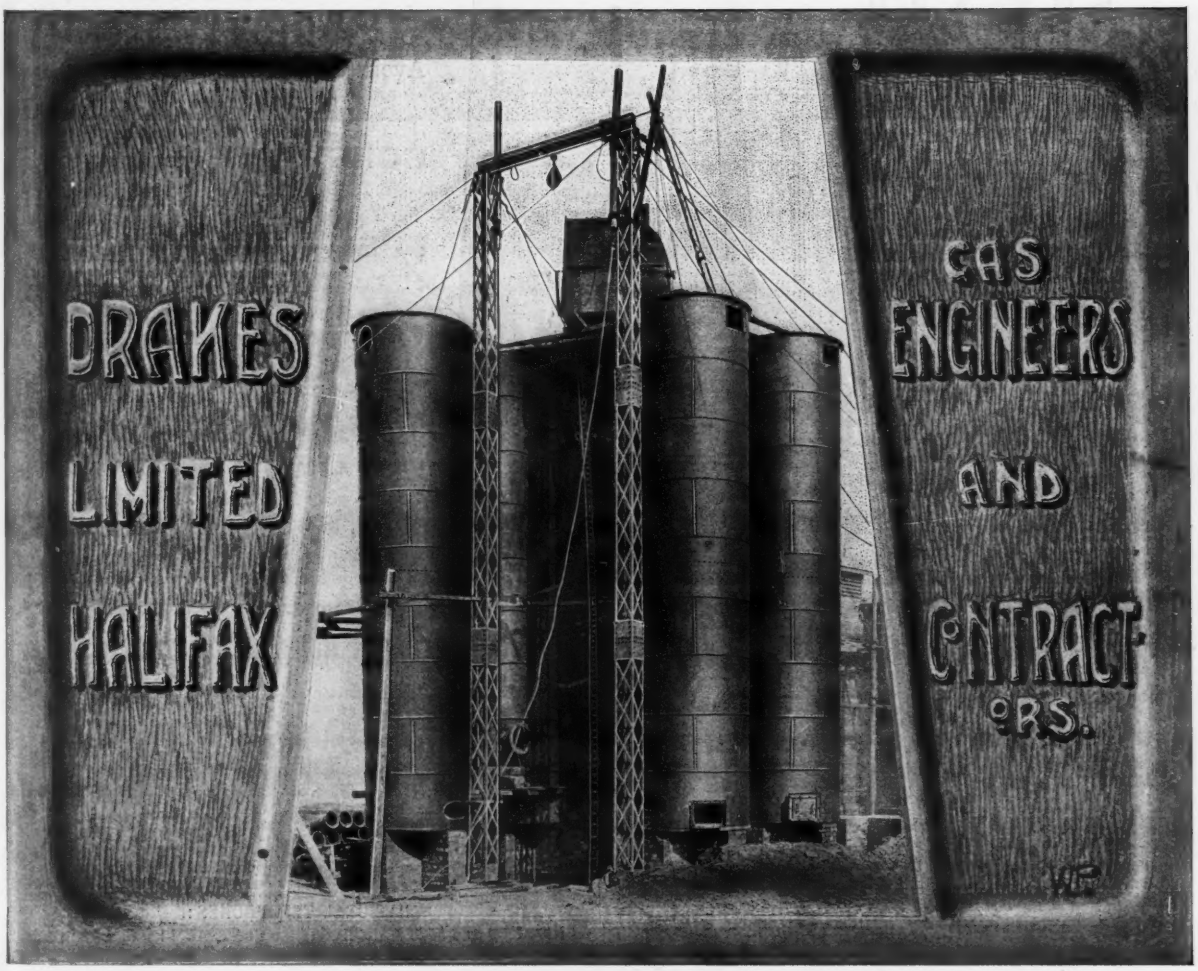

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IN

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VERTICAL RETORTS

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MADE BY

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AT THE

St. Helens Gas-Works,

WITH

Thornley [Durham] Coal.

GAS made per Ton,
13,102 cubic feet.

Average Illuminating Power,
15·56 candles,
No. 2 Metropolitan Burner.

Average Calorific value (Gross),
573·6 B.T.U.

COKE (Dry) produced per ton of Coal, **14·2** cwt.

FUEL, Coke per 100 lbs. of Coal carbonized, **12·3** lbs.

TAR, free from Liquor,
12·3 gallons per ton.

AMMONIACAL LIQUOR,
31·7 gallons 10 oz. per ton.

See "JOURNAL OF GAS LIGHTING," June 8 & July 20, 1909, for description and results.

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